MAINTENANCE MANUAL

YOUR INTERFACE UNIT MAY BE IDENTIFIED BY EITHER TEKTRONIX PART NUMBER 015-0180-00 OR TEKTRONIX PART NUMBER 021-0018-00. THIS INSTRUCTION MANUAL IS APPLICABLE IN EITHER CASE.

T4005/4201

015-0180-00

INTERFACE UNIT

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070-1087-00 1170

WARRANTY

All Tektronix instruments are warranted against defective materials and workmanship for one year.

Any questions with respect to the warranty, mentioned above should be taken up with your Tektronix Field Engineer or Representative.

All requests for repairs and replacement parts should be directed to the Tektronix Field Office or representative in your area. This procedure will assure you the fastest possible service. Please include the instrument Type (or Part Number) and Serial or Model Number with all requests for parts or service.

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Abbreviations and symbols used in this manual are based on or taken directly from IEEE Standard 260 "Standard Symbols for Units", MIL-STD-12B and other standards of the electronics industry. Change information, if any, is located at the rear of this manual.

SECTION 1
SPECIFICATION

Change information, if any, affecting this section will be found at the rear of this manual.

Introduction

The 015-0180-00 Interface Unit is designed to interface the IBM 1130 Computing System and the Graphic Display Controller (4201) portion of the T4005. The 015-0180-00 Interface Unit accepts data from, and transfers data to, the IBM 1130 Computing System. The data is transferred in parallel over 16 Channel Data Lines under direct program control, using the 1130's interrupt and timing control systems. The Interface Unit connects to the 1130 via the Storage Access Channel (SAC) on the 1131 Central Processing Unit, or through the SAC II connection if the Computing System is equipped with an IBM 1133 Multiplex Control Enclosure. The Interface Unit is housed within the 4201 drawer unit inside the T4005 console.

IBM 1130 SAC Cable

A 50-twisted-pair, 20 foot, vinyl jacketed cable connects the Graphic Display Controller (GDC) to the IBM 1130 (45 pairs are currently used, 5 pairs are spares). The computer connection is made via a 160-pin connector as specified in IBM Form A26-3645-5, IBM 1130 Computing system Storage Access Channel Original Equipment Manufacturer's Information (1130 OEMI Manual). The GDC connection is cable-clamped to the rear panel of the GDC. After passing through the rear mounting plate, the cable splays out for multi-connections to the Interface Interconnect Board. A three-position switch is located on the GDC rear mounting plate to control the GDC's ability to interrupt the computer.

General

The characteristics described in this section of the manual are valid only when the Interface Unit is installed and operating with a complete T4005 or 4201, calibrated at an ambient temperature between +20°C and +30°C. Unless otherwise noted, the whole system must be operating for at least 20 minutes within a temperature range of +20°C to +40°C at sea level before validating the instrument performance.

Definitions

The meanings of abbreviations used in this manual are given below. See IBM Form A26-3645-5, IBM 1130 Computing System Storage Access Channel Original Equipment Manufacturer's Information for further information.

CPU	Central Processing Unit
DSW	Device Status Word
GDC	Graphic Display Controller
ILSW	Interrupt Level Status Word
IOCC	Input/Output Control Command
LSB	Least Significant Bit
MSB	Most Significant Bit
OEMI	Original Equipment Manufacturer's Information
SAC	Storage Access Channel
SBR	Storage Buffer Register
XIO	Execute Input/Output

GENERAL CHARACTERISTICS

PROGRAM CONTROL RESPONSES

IOCC	DEFINITIONS
IOCC Word Field Assignments	Bits 0 (MSB) – 4 Area Code Field Bits 5 – 7 Function Field Bits 8 – 15 (LSB) Modifier Field
GDC Response Assignments	Decoded by 015-0180-00 Interface Unit during computer XIO E-1 cycle (see Fig. 1-1).
IOCC Area Code	Hexadecimal COXX = Binary 1100 0XXX XXXX XXXX = Decimal +24

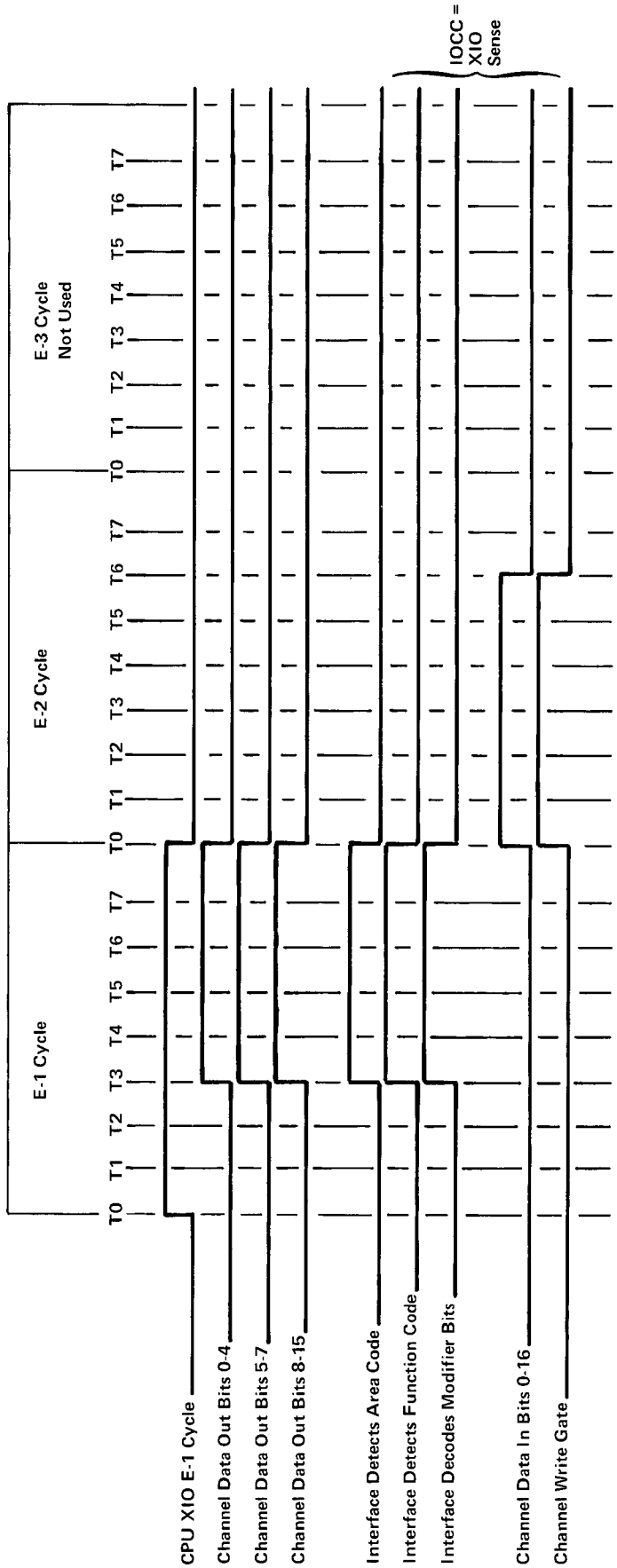


Fig. 1-1. Data Transfer Timing

GENERAL CHARACTERISTICS (cont)

IOCC	DEFINITIONS
IOCC Function Code and Modifier Bit Assignments	
GDC Device Control	COXX = 1100 0000 AABB CCDD The function code 000 (in Bits 5 – 7) is not normally used by the 1130 software, but is used by T4005/4201 software for device control. In the modifier field (Bits 8 – 15), the AA, BB, CC, and DD bits control the GDC display devices I, II, III, and IV respectively. Modifier Bit Pairs Code — Action 00 — No Change 01 — *Select Non-Store Mode 10 — *Select Store Mode 11 — Turn Off in current mode *When changing a display device mode, program a time delay at least as long as that device's display mode switching time.
Write	C1XX = 1100 0001 ZDDD IIII This function code is interpreted as a beam control command, i.e., Write. In the modifier field: Bit 8 (Z) controls the Z Axis for those display devices selected. Bit 8 = 1 = Beam ON. Bit 8 = 0 = Beam OFF. Bits 9 – 11 (DDD) control the GDC X and Y Axis directions.

Code	Direction		GDC Strobe Activated
000		+Y	+X Strobe
001	+X	+Y	
010	+X		–X Strobe
011	+X	–Y	
100		–Y	+Y Strobe
101	–X	–Y	
110	–X		–Y Strobe
111	–X	+Y	

Bits 12 – 15 (IIII) control the iteration of the GDC X and Y Strobes.

1) If the decimal value is 1 through 15, the Strobes will be activated at the given number of times.

2) If the decimal value is 0 and Bit 8 is 0, then the GDC's SKIP line is activated along with the strobes.

Bits 8 – 15 = 0DDD 0000

3) If the decimal value is 0 and Bit 8 is 1, then the GDC's AUX WRITE line is activated.

GENERAL CHARACTERISTICS (cont)

IOCC	DEFINITIONS
IOCC Function Code and Modifier Bit Assignments (cont)	
Software Lights	C6XY = 1100 0110 ABCD EFGH This function code is usually the 1130's Initiate Read function, but it is interpreted by the GDC as a request to selectively light the interrupt buttons (A – H). In the modifier field, a 1 in any bit position A, B, C, D, E, F, G, and H will light the corresponding lettered button on the GDC's control panel. A 0 will turn off a lighted button.
Sense Interrupt	X3XX = XXXX X011 XXXX XXXX This function does not require an Area Code, only a CPU XIO E-1 cycle and the appropriate code in Bits 5, 6, and 7. If, and only if, there is a match between a request level and a service level, the CHANNEL WRITE line will be activated, thus transferring the ILSW bit of any device requesting an interrupt on that level.
Sense Device	C7X4 = 1100 0111 DDDD XQRS This function code instructs the GDC to send the indicated DSW to the CPU and resets the GDC interrupt requests. In the modifier field, the DDDD bits represent the GDC's DSW number. The Q Bit (Bit 13) resets the GDC's Accessory Interrupt Request. The R bit (Bit 14) resets the GDC's Real Time Clock Interrupt Request. The S bit (Bit 15) resets the GDC's Software Control pushbutton Interrupt Request. The decimal value in Bits 8 – 11 selects a DSW with the same number from the Interface card Acc-12 in the Auxiliary area of the GDC. Only decimal values 0 through 5 are recognized by Acc-12. Refer to the Specification section of the T4005/4201 Maintenance Manual for the contents of 16-bit Device Status Words.
Control	C4XY = 1100 0100 AAAA BBBB This function code causes the GDC to perform a control action specified in the modifier field. The AAAA bits contain the decimal value for Control Field A. The BBBB bits contain the decimal value for Control Field B. See Table 1-1 for Control Field meanings.

TABLE 1-1

CONTROL FIELD CODING

Control Field A Bits 8 – 11 Decimal Value	Control Field B Bits 12 – 15 Decimal Value	FUNCTION
1	Any	Sets the GDC VERT DISPLAY SCALE to 256.
2	Any	Sets the GDC VERT DISPLAY SCALE to 512.
3	Any	Sets the GDC VERT DISPLAY SCALE to 1K.
4	Any	Sets the GDC VERT DISPLAY SCALE to 2K.
5	Any	Sets the GDC VERT DISPLAY SCALE to 4K.
6	Any	Sets the GDC VERT DISPLAY SCALE to 8K.
7	Any	Sets the GDC VERT DISPLAY SCALE to AUGMENT.
8	Any	Puts GDC in READY Mode.
9	Any	Puts GDC in FRAME Mode.
10	Any	Puts GDC in LOCATOR Mode.
11	Any	Turns on GDC Frame Generator.
12	Any	Turns on GDC Locator.
13	Any	Slants GDC Plot.
14	Any	Shifts GDC Plot.
Any except 15	1	Sets GDC HORIZ DISPLAY SCALE to 256.
Any except 15	2	Sets GDC HORIZ DISPLAY SCALE to 512.
Any except 15	3	Sets GDC HORIZ DISPLAY SCALE to 1K.
Any except 15	4	Sets GDC HORIZ DISPLAY SCALE to 2K.
Any except 15	5	Sets GDC HORIZ DISPLAY SCALE to 4K.
Any except 15	6	Sets GDC HORIZ DISPLAY SCALE to 8K.
Any except 15	7	Sets GDC HORIZ DISPLAY SCALE to AUGMENT.
Any except 15	8	Resets the GDC function.
Any except 15	9	Places the display device in VIEW.
Any except 15	10	Places the display device in WRITETHROUGH.
Any except 15	11	Erases the display device.
Any except 15	12	Erases the display device if in AUTO ERASE.
Any except 15	13	Puts the GDC in AUTO ERASE Mode.
Any except 15	14	Lower Non-store.
Any except 16	15	Lower Erase.
15	0	Reserved for control in GDC Accessory area.
15	1	Reserved for control in GDC Accessory area.
15	2	Reserved for control in GDC Accessory area.
15	3	Reserved for control in GDC Accessory area.
15	4	Reserved for control in GDC Accessory area.
15	5	Reserved for control in GDC Accessory area.
15	6	Reserved for control in GDC Accessory area.
15	7	Reserved for control in GDC Accessory area.
15	8	Reserved for control in GDC Accessory area.
15	9	Reserved for control in GDC Accessory area.
15	10	Reserved for control in GDC Accessory area.
15	11	Reserved for control in GDC Accessory area.
15	12	Disables GDC's interrupt structure.
15	13	Enables GDC's interrupt structure.
15	14	Disables the GDC Real Time Clock.
15	15	Enables the GDC Real Time Clock.
0	0	No functions
0	Any	Control Field B exclusively.
Any except 15	0	Control Field A exclusively.

ELECTRICAL CHARACTERISTICS

Characteristic	Performance Requirements	Supplemental Information
Communication Mode		Full-duplex, parallel data transfer
Word Size		16 bits. Bit 0 = MSB; Bit 15 = LSB
Data Transfer Timing		See Fig. 1-1
Logic Type		Positive Form: SIGNAL NAME = Active at the high level. SIGNAL NAME = Active at the low level
Logic Levels		Specified according to 1130 OEMI Manual, page 25, Fig. B, and page 26, Fig. 14.
Input Lines		
Normal Up-Level	+3.0 V, within 4%, 0 mA	
Maximum Allowable Up-Level	+6.0 V, sourcing 5 mA	
Minimum Allowable Up-Level	*V, sourcing 3.5 mA *Voltage determined by input impedance	
Normal Down-Level	+0.3 V, within 4%, sourcing 38 mA or less	
Maximum Allowable Down-Level	0 V	
Output Lines		
Normal Up-Level	+3.0 V, within 4%, 0 mA	
Maximum Allowable Up-Level	+6.0 V, sinking 30 mA	
Minimum Up-Level	+1.8 V, sourcing 12 mA	
Normal Down-Level	+3.0 V, within 4%	
Maximum Allowable Down-Level	−3.12 V (When V = 0, sourcing 33 mA)	
Maximum Down-Level	+0.9 V, sourcing 21 mA	
Maximum Noise Level On Any Signal Line	300 mV	
Falltime (From Up-Level to Down-Level)	20 ns or less	
Nominal CPU Clock Pulse Widths		
For 2.2 μs Core Storage	275 ns	
For 3.4 μs Core Storage	440 ns	
Nominal Channel Write Gate Duration		XIO E-2 cycle, T0 through T6 (see Fig. 1-1).

ELECTRICAL CHARACTERISTICS (cont)

Input Lines to 015-0180-00 Interface Unit From IBM 1130 SAC

1130 OEMI Manual SAC Signal Name	Interface Connections				Line Function
	SAC Connector		Interface Unit		
	Signal Line	Gnd. Return	Gnd. Return	Signal Line	
Channel Data Out Bit $\overline{0}$	R3	S7	J113-10	J113-2	These lines provided for data exit from the 1130's Storage Buffer Register (SBR) and contain the input/output control command (IOCC) word to the 015-0180-00 Interface Unit.
$\overline{1}$	R8	T3	J113-9	J113-1	
$\overline{2}$	P6	S1	J114-16	J114-8	
$\overline{3}$	R2	S6	J114-15	J114-7	
$\overline{4}$	R4	S8	J114-14	J114-6	
$\overline{5}$	R9	T4	J114-13	J114-5	
$\overline{6}$	P7	S2	J114-12	J114-4	
$\overline{7}$	T5	T6	J122-11	J122-3	
$\overline{8}$	R5	S9	J122-12	J122-4	
$\overline{9}$	T7	T8	J122-13	J122-5	
$\overline{10}$	P8	S3	J122-14	J122-6	
$\overline{11}$	T9	V1	J122-15	J122-7	
$\overline{12}$	R6	T1	J122-16	J122-8	
$\overline{13}$	V3	V2	J114-10	J114-2	
$\overline{14}$	P9	S4	J114-9	J114-1	
$\overline{15}$	V5	V4	J114-11	J114-3	
$\overline{\text{Channel Reset}}$	R7	T2	J113-15	J113-7	This DC reset signal results from power-on reset or operation of the 1130 CPU console reset key.
$\overline{\text{CPU Clock T–0}}$	E5	F9	J113-14	J113-6	These are CPU Timing Pulses used for synchronization during an XIO E-cycle execution.
$\overline{\text{T–4}}$	E6	G1	J113-13	J113-5	
$\overline{\text{T–6}}$	D9	F4	J113-12	J113-4	
XIO E-1 Cycle	G8	H5	J113-16	J113-8	This signal indicates the beginning of the execution phase of an XIO instruction.
Channel Int. Lvl. 2	H6	J5	J112-11	J112-3	These lines indicate the highest level interrupt operation currently in progress. These lines gate the proper interrupt level status word (ILSW).
3	H1	J2	J112-10	J112-2	
4	H7	J6	J112-9	J112-1	
$\overline{\text{Meter Out}}$	E1	F5	J113-11	J113-3	This line indicates the CPU is running.
Channel Data In Bit 0	A1	A4	J123-16	J123-8	These lines provide for data entry to the 1130's SBR. Data transfer is controlled by the Channel Write Gate signal.
1	B1	C5	J110-16	J110-8	
2	A3	A6	J110-15	J110-7	
3	B8	D3	J112-16	J112-8	
4	A2	A5	J112-15	J112-7	
5	B2	C6	J112-14	J112-6	
6	B4	C8	J112-13	J112-5	
7	B9	D4	J112-12	J112-4	
8	A7	C2	J110-14	J110-6	
9	B3	C7	J110-12	J110-4	

ELECTRICAL CHARACTERISTICS (cont)

Input Lines to 015-0180-00 Interface Unit From IBM 1130 SAC

1130 OEMI Manual SAC Signal Name	Interface Connections				Line Function
	SAC Connector		Interface Unit		
	Signal Line	Gnd. Return	Gnd. Return	Signal Line	
10	B5	C9	J111-13	J111-5	
11	C1	D5	J111-10	J111-2	
12	A8	C3	J111-9	J111-1	
13	E3	F7	J123-13	J123-5	
14	B6	D1	J123-14	J123-6	
15	D6	F1	J122-9	J122-1	
$\overline{\text{Channel Write Gate}}$	B7	D2	J123-12	J123-4	This signal causes data on the Channel Data In lines to be loaded into the 1130's SBR.
$\overline{\text{Channel Int. Req. 2}}$	E8	G3	J111-16	J111-8	These lines may be activated by the SAC user to initiate a program interrupt. The request is reset by an X10 sense instruction with reset modifier bit.
$\overline{3}$	E2	F6	J122-10	J122-2	
$\overline{4}$	E9	G4	J123-15	J123-7	

ENVIRONMENTAL CHARACTERISTICS

	Interface Unit Within a T4005 System
Parameter	Performance Limits
Temperature (Ambient	The 015-0180-00 Interface Unit is completely compatible with the environmental specifications for the T4005 Graphic Display and the 4201 Graphic Display Controller.
Operating Range	
Storage Range	
Altitude	See T4005/4201 Maintenance Manual.
Operating Range	
Storage Range	

SECTION 2
CIRCUIT DESCRIPTION

Change information, if any, affecting this section will be found at the rear of this manual.

This section of the manual contains a description of the circuitry used for interface between the 4201 GDC and an IBM 1130. The purpose of the circuit description is to provide information for troubleshooting and evaluation of the Interface Unit. Input/Output information is contained in Section 1, Specification. The operation of the circuits within the Interface Unit is described using the graphic symbols and terminology set forth in military standard MIL-STD-806B. The use of an overline on a signal name (e.g., $\overline{\text{ENABLE}}$) is to indicate that the active state of the signal is a Low state.

The 015-0180-00 Interface Unit consists of an Interface Interconnect Board and four cards (IF-1 through IF-4).

Interface Interconnect Board

All the electrical connections between the Graphic Display Controller (GDC) and the Computer are made via this board. The board accepts ten cable connectors from the IBM 1130 SAC cable, and four connectors from the GDC. This board also mates with six interface card holders; however, only four cards (IF-1 through IF-4) are required for the GDC-1130 interface. Power for these cards is from the GDC through a special cable and square pin connectors.

CARD IF-1

CPU Line Driver

The Central Processing Unit (CPU) Line Driver Card provides the necessary level shifting and impedance matching required between the TTL logic in the GDC, and the different voltage levels and impedance (95 ohm) of the 1130 SAC Receivers and cable. This card drives twenty input lines to the SAC; 16 channel data input lines (Data Bit in 0 through Data Bit In 15), three channel interrupt request lines (Interrupt Request 2, 3, and 4), and the Channel Write Gate Line.

Options are provided on this card to select Button, Clock, and Accessory Interrupt Level 2, 3, or 4 (interrupt level selected must match the Program being used). A Deactivate/Disarm option (discussed later) is provided for the Button and Accessory Interrupts when the Programmable position on the rear panel switch is selected.

The Interrupt and Channel Write Gate signals are fed to the computer through Line Drivers Q29, Q21, Q24, and Q27. These signals are prevented from going to the computer, while the T4005 is being powered up or down, by removing the forward bias from the Line Drivers mentioned above. Turn-on bias is applied or removed from these line drivers by contacts of relay K18. Relay K18 is controlled by Q14, Q16, Q18 and their associated circuitry.

At the time power is turned on, Q18 is biased off, keeping the contacts of relay K18 open while C16 and C17 charge, through R16, toward +5 volts. When the charge on C16 and C17 reaches approximately +1.8 volts, Q18 turns on. The turn-on of Q18 energizes K18, causing the relay contacts to close and apply turn-on bias voltage to the Line Drivers (Q29, Q21, Q24, and Q27).

When the T4005 power is turned off, detector circuit Q14 and its associated bias network detects the decay in the +5 volt supply voltage. Transistor Q14 has been "off" with its base at +4.7 volts and emitter at +5 volts. As the +5 volt supply voltage decays, Q14 base voltage decreases while its emitter is held at +5 volts by C13. A slight decay in the +5 volt supply is therefore sufficient to turn on Q14 and cause SCR Q16 to fire. Capacitors C16 and C17 are rapidly discharged and forward-bias is removed from Q18. Turning off Q18 causes the contacts of K18 to open disabling Line Drivers Q29, Q21, Q24 and Q27.

The three position rear panel switch (Enable, Programmable, Disable) affects the operation of the three interrupt signals. With this switch set to the Disable position, the Line Drivers for all three interrupts are disabled. The T4005 is therefore unable to interrupt the computer. A Clock Interrupt Request is prevented by grounding pin V of P-31, through the left section of switch S154. The right section of switch S154 grounds pin 27 of P-31. This ensures the flip-flop composed of U2A, U2B is in the state that will disable Accessory or Button Interrupt Requests. A HIGH at pin 8 of U2B turns on Q22 and Q19. Conduction of Q22 prevents Line Driver Q29 from recognizing an Accessory Interrupt Request, and conduction of Q19 prevents turn-on of Q21 by a Button Interrupt Request.

When the rear panel switch is set to the Enable position, the Accessory, Button, and Clock Interrupt Requests are sent through their associated Line Drivers to the computer,

except when the T4005 is being powered up or down. Flip-flop U2A/U2B is switched to its interrupt enable state by grounding pin DD of P-31 through the left section of S154, and the computer is unable to switch the flip-flop to its disabled state.

With the rear panel switch set to the Programmable position switch S154 does not determine the state of flip-flop U2A/U2B. When first selecting Programmable the flip-flop goes to the disabled state. Neither pin DD nor pin 27 of P-31 is grounded by S154. The computer now determines the state of the flip-flop, and therefore determines when an Accessory or Button Interrupt Request will be recognized. The computer can not prevent recognition of a Clock Interrupt Request.

As mentioned earlier, a Deactivate/Disarm option is provided for use in conjunction with the PROGRAMMABLE (computer initiated command) position of S154. With either option, an accessory or Button Interrupt Request will be immediately sent to the computer, provided that the computer has not switched flip-flop U2A/U2B to its disabled state.

With the collector of Q19 connected to the anode of CR20 (Disable option) a Button Interrupt Request is held Pending until the computer switches U2A/U2B to its interrupt enable state. The Pending Interrupt will then be transmitted to the computer. With the collector of Q19 connected to the cathode of CR20 (Disarm option) a Button Interrupt Request, ocurring while the flip-flop is in its interrupt disable state, will be lost since the collector of Q19 is no longer isolated from the Button Interrupt Request line by CR20.

The strappable option from the collector of Q22, for the Accessory Interrupt Request, functions in the same manner as the Button Interrupt Request option just described. The Real Time Clock can interrupt any time the rear panel Enable/Disable switch (S154) is not in the Disable position.

CARD IF-2

CPU Line Receiver

The CPU Line Receiver Card provides the level shifting and impedance matching required between the SAC line drivers and the GDC. Twenty-five lines from the SAC are terminated by this card; 16 Channel Data Out Bit lines, CPU Meter Out, Channel Reset line, three CPU Clock lines (T0, T4, and T6), X1O E-1 Cycle line, and three Interrupt Level Service lines (Int. Lev. 2, 3, and 4). The strappable option for Button, Clock, and accessory Interrupt Level must be the same as those chosen for these signals on Card IF-1.

CARD IF-3

Interface Decoder

The Interface Decoder Card provides virtually all of the decoding between the commands issued by the Computer and the functional strobes and levels required to drive the GDC control electronics. Buffered from the SAC by the CPU Line Driver and the CPU Line Receiver Cards, the Interface Decoder Card operates totally in a TTL environment. A full understanding of the decoding functions requires an understanding of the Input/Output operations of the computer. See IBM Publication GA26-3645-5 (IBM 1130 Computing System — Storage Access Channel).

This Card recognizes when the computer is executing an IOCC (input/output control command) called an XIO instruction and it further recognizes if the instruction is directed towards the GDC. The 5 high order CPU Bits (Bit 0 through Bit 4) of the IOCC are used for device area code and can be connected to respond to any area code 0 through 31. The area code assigned to the GDC is set by appropriate placement of jumpers to the input of U58. This area code is included in all computer commands except for an ILSW (Interrupt Level Status Word). An ILSW is applicable to all devices connected to the computer.

CPU Bits 5, 6, and 7 of the IOCC determine the function (type of activity) to be performed. An additional 8 bit modifier field (CPU Bit 8 through Bit 15) of IOCC is used to further specify the precise function called for by the computer XIO command.

CARD IF-4

The 8 bit modifier field (CPU Bit 8 through 15) is applied to the BCD to Decimal decoders U2, U3, and U4 to drive up to two control lines sumultaneously out of 45 possible GDC control lines. Details of the modifier field bit logic levels and the GDC lines activated are given in the Specification Section of this manual.

COMPUTER COMMANDS

The IOCC (Input/Output Control Command) word field assignment for the GDC is as shown in Fig. 2-1.

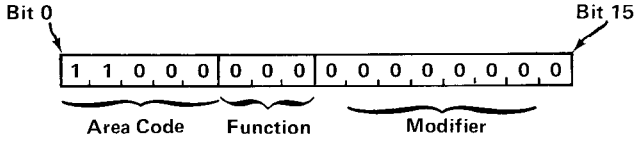


Fig. 2-1. The three parts of an IOCC word

Area Code

The first five bits (bits 0 through 4) of the word indicate the device the computer is addressing. The 4201 Graphic Display Controller may be wired to accept any area code from 0 through 31. The 4201 is normally assigned Area Code 24 (11000), which does not conflict with area codes assigned to any IBM provided device.

Function Code and Modifier Bit Assignments

CPU Bits 5, 6, and 7 of the IOCC determine the function to be performed. Table 2-1 lists the coding required to select the functions shown.

TABLE 2-1

Meaning of CPU bits 5, 6, and 7

CPU Bit			Function
5	6	7	
0	0	0	Select Device(s)
0	0	1	Write
0	1	1	Sense Interrupt
1	0	0	Control
1	1	0	Select Software Lights
1	1	1	Sense Device

CPU clock pulses T0, T4 and T6 provide the timing necessary to decode the computer command.

The Modifier (Bits 8 through 15) meaning is dependent on which Function (Bits 5 through 7) is selected. The meaning of the Modifier for each Function is discussed below.

Device Control. As shown by Table 2-1, Select Device is selected when binary number zero (0000) is represented by bits 5, 6, and 7 of the IOCC word. Fig. 2-2 also shows that the function code required for device control is a binary zero.

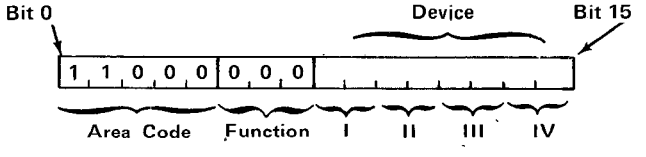


Fig. 2-2. Function code for Device Control

When device control is selected by the function code, four devices are controlled in accordance with the code shown in Table 2-2. This two bit code applies to each of the four devices. Bits 8 and 9 control Device I, bits 10 and 11 control Device II, etc.

TABLE 2-2

Meaning of Modifier for Device Control Function

Code	Meaning
00	No change
01	Select (connect) the device in Non-Store Mode
10	Select (connect) the device in Store Mode
11	Disconnect (turn off) the device in whichever Mode it was selected.

Write. The command for write is zero zero one (001) in bits 5, 6, and 7 of the IOCC word. Fig. 2-3 shows the meaning of modifier bits 8 through 15 when the Write function is selected.

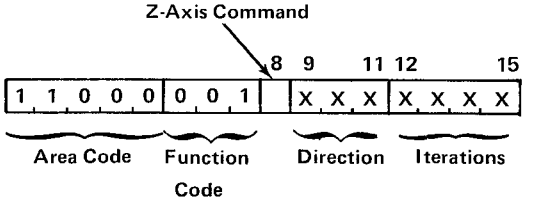


Fig. 2-3. IOCC for Write Function

Bit 8 of the IOCC word controls the Z axis. A one in bit 8 causes a dot to be written while a zero does not.

Bits 8, 9, and 10 determine the direction of dot movement. The 8 possible directions of dot movement with direction binary numbers zero through seven is shown in Fig. 2-4.

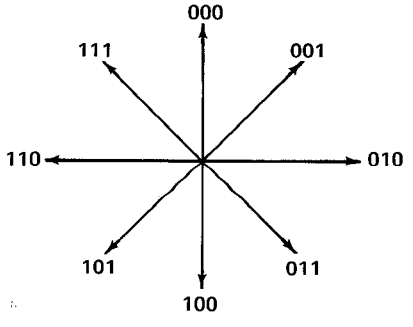


Fig. 2-4. Code for direction of dot movement

Bits 12 through 15 determine the number of increments of pen movement that the interface (IF-3) will execute per one write command. The number of increments of movement is equal to the binary number represented by bits 12 through 15 of the IOCC word (see Fig. 2-3). The pen will increment 1 to 15 positions in the direction dictated by bits 9, 10, and 11.

Two special Write Functions, available when the Iteration bits represent binary number zero (0000), are Skip Ahead and Pen Drop. The modifier bit values required for these two cases are shown in Figures 2-5 and 2-6.

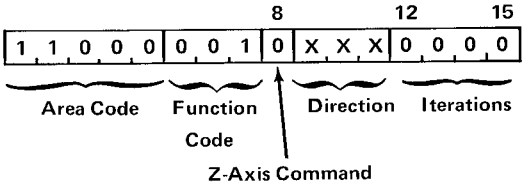


Fig. 2-5. IOCC for Skip Ahead

A zero in bit 8 and bits 12 through 15 of the IOCC word results in the Skip Ahead command. This command causes the equivalent of 256 increments to be made in the direction indicated by bits 9, 10, and 11. No dots are written. This command results in a considerable saving in time when the dot is to be moved over a large distance.

The IOCC for Pen Drop is shown in Fig. 2-6. This command writes a dot without incrementing.

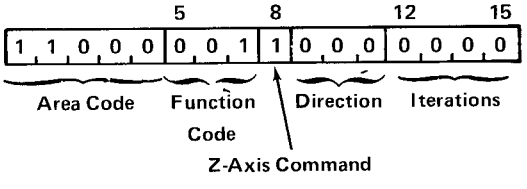


Fig. 2-6. IOCC for Pen Drop

Sense Interrupt. This function does not require an Area Code, only a CPU XIO E-1 cycle and the appropriate code in bits 5, 6, and 7. The IOCC for Sense Interrupt is shown in Fig. 2-7.

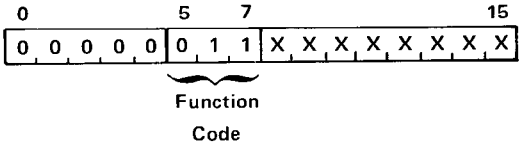


Fig. 2-7. IOCC for Sense Interrupt

If, and only if, there is a match between a request interrupt level and a service interrupt level, will the Channel Write line be activated.

Software Lights. Software lights are selected when binary number six (110) is represented by bits 5, 6, and 7 of the IOCC word. See Fig. 2-8. This function code is used to turn on lights corresponding to bits 8 through 15 only. In the modifier field (bits 8 through 15), a ONE in any bit position A, B, C, D, E, F, G, or H will light the corresponding lettered button on the GDC's control panel. A zero will turn off a lighted button.

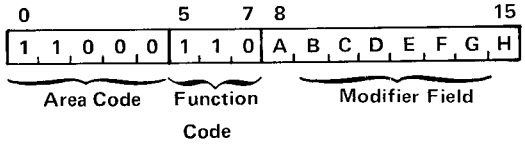


Fig. 2-8. IOCC for Software Lights

Sense Device. Fig. 2-9 shows the meaning of bits 8 through 15 when the Function Code bits are one, one, one (111).

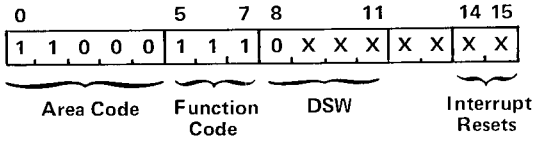


Fig. 2-9. IOCC for Sense Device

This command instructs the GDC to send the indicated DSW (Device Status Word) to the CPU and resets the GDC interrupts. Bits 8 through 11 specify which of six DSW (0 through 5) the GDC is to load into the accumulater. A one in bit 14 resets Clock Interrupts. A one in bit 15 resets Button Interrupts. Do not reset interrupts is indicated by a zero in bit 14 and/or 15.

TABLE 2-3

Device Status Word Contents

Device Status Word	Meaning with a one (1) in bit position indicated
DSW 0	Bit 0 Ready, Not busy and at least one device selected.
	Bit 1 At least one device selected.
	Bit 2 Button interrupt disabled
	Bit 3 Auto erase
	Bit 4 Augment (vertical)
	Bit 5 Augment (horizontal)

TABLE 2-3 (cont)

DSW 0 (cont)	Bit 6	Image shifted
	Bit 7	Image slanted
	Bit 8	Frame generator "ON"
	Bit 9	Locate generator "ON"
	Bit 10 Bit 11 Bit 12	Button Interrupt Number (A through G are decimal 1 through 7; H is decimal 0.)
	Bit 13 Bit 14 Bit 15	DISPLAY NUMBER (1 through 7 are decimal 1 through 7; 8 is decimal 0.)
DSW 1	Bit 0	Ready Mode
	Bit 1	Frame Mode
	Bit 2	Locate Mode
	Bit 3	DISPLAY DEVICE I selected
	Bit 4	DISPLAY DEVICE II selected
	Bit 5	DISPLAY DEVICE III selected
	Bit 6	DISPLAY DEVICE IV selected
	Bit 7	X-Y Plotter selected
	Bit 8	Storage Device Type 1*
	Bit 9	Storage Device Type 2*
	Bit 10	Storage Device Type 3*
	Bit 11	Storage Device Type 4*
	Bit 12	Non-Store Device Type 1*
	Bit 13	Non-Store Device Type 2*
	Bit 14	Non-Store Device Type 3*
	Bit 15	Non-Store Device Type 4*

DSW 2	Bits 0 through 2 indicate the contents of the "X" Present Scale Latch. (note 2) Bits 3 through 15 indicate the contents of the "X" Main Register.
DSW 3	Bits 0 through 2 indicate the contents of the "Y" Present Scale Latch. (note 2) Bits 3 through 15 indicate the contents of the "Y" Main Register.
DSW 4	Bits 0 through 2 indicate the contents of the "X" Last Scale Latch. (note 2) Bits 3 through 11 indicate the contents of the "X" Offset Register. Bits 12 through 15 are reserved.
DSW 5	Bits 0 through 2 indicate the contents of the "Y" Last Scale Latch. (note 2) Bits 3 through 11 indicate the contents of the "Y" Offset Register. Bits 12 through 15 are reserved.
DSW 6 through DSW 15	Unused.

**NOTE 1*

Only devices selected are referred to in DSW 1. Device types are as follows:

1. *Reserved*
2. *Oscilloscopes*
3. *Type 601, Type 602, 4501 and other small screen displays*
4. *Type 611 and other large screen displays*

EXAMPLE: A Type 611 selected in Non-Store Mode results in a one (1) in bit 15 or DSW 1. Switching the 611 to the Store Mode results in a one (1) in the bit 11 position of DSW 1.

NOTE 2

The Scale Latches (bits 0 through 2) of DSW 2, 3, 4, and 5 are coded as follows:

001 = 256	*100 = 2K*
010 = 512	*101 = 4K*
011 = 1K	*110 = 8K*

Control. Control command can cause two control functions to be carried out simultaneously. These functions are coded into two separate fields in the Modifier bits as shown in Fig. 2-10. When either field is zero, no action is performed for that field. When field 1 is 15 (hex F), sixteen alternate functions can be performed by the code in field 2.

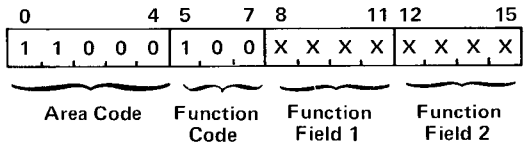


Fig. 2-10. IOCC Code for Control

The Function Field codes are as shown in Table 2-4.

TABLE 2-4

Meaning of Function Field Bits

Field	Bits 8	9	10	11	Action
Function Field	0	0	0	0	No Action
	0	0	0	1	256
	0	0	1	0	512
	0	0	1	1	1K
	0	1	0	0	2K
	0	1	0	1	4K
	0	1	1	0	8K
	0	1	1	1	VERT AUGMENT off
	1	0	0	0	Force READY Mode
	1	0	0	1	Force FRAME Mode
	1	0	1	0	Force LOCATE Mode
	1	0	1	1	Turn FRAME generator on (note 1)
	1	1	0	0	Turn LOCATE generator on (note 1)
	1	1	0	1	Slant Display (note 2)
	1	1	1	0	Shift Display (note 3)
	1	1	1	1	Alternate Function 2
	Bits 12	13	14	15	
Function Field 2	0	0	0	0	No Action
	0	0	0	1	256
	0	0	1	0	512
	0	0	1	1	1K
	0	1	0	0	2K
	0	1	0	1	4K
	0	1	1	0	8K
	0	1	1	1	VERT AUGMENT off
	1	0	0	0	Function Reset (note 4)
	1	0	0	1	Turn View Lock on (note 5)
	1	0	1	0	Put selected devices into Write-Thru Mode (note 5)
	1	0	1	1	Erase selected devices
	1	1	0	0	Conditional Erase to selected devices
	1	1	0	1	Force AUTO ERASE on
	1	1	1	0	Force lower half of screen into Non-Store Mode (note 5)
	1	1	1	1	Erase lower half of screen (note 5)
Alternate Function Field 2	0	0	0	0	Software Initial
	X	X	X	X	0001 through 1011 are unused
	1	1	0	0	Disable Button Interrupts
	1	1	0	1	Enable Button Interrupts
	1	1	1	0	Disable Clock
	1	1	1	1	Enable Clock

NOTE 1

The FRAME and LOCATE generators are intended for software control only in the READY Mode. FRAME and LOCATE are mutually exclusive. The FRAME and LOCATER will appear on the screen exactly where the spot would if the generators were off. They are moved, as the spot would be, with Write commands to increment the Main Registers. However, they are not subject to Z-Axis control. They are never blanked. If the programmer wants blanking, he must provide it by turning off the generator.

NOTE 2

When Slant display is selected, the square screen becomes a parallelogram. See Fig. 2-11. The FRAME, LOCATER, and any display put up in Slant status is slanted. In Fig. 2-11 every point (X, Y) is mapped into a new point (X^1, Y^1) by the rule:

$$Y^1 = Y$$

$$X^1 = X \pm 1/4\ Y$$

where zero to one is considered a full-screen deflection.

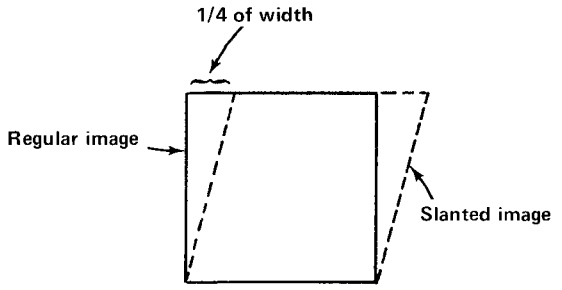


Fig. 2-11. Effect of Slant Display on image

NOTE 3

When Shift Display is selected, the square display shifts to the left 1/4 of its width. See Fig. 2-12. The FRAME, LOCATER, and any display put up in Shift status is shifted.

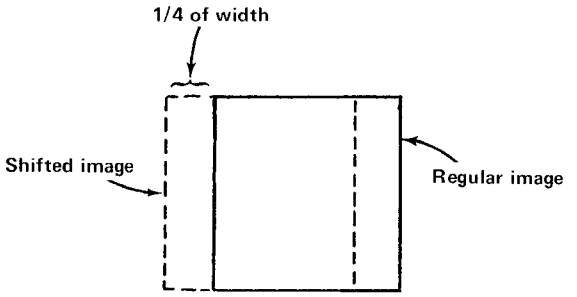


Fig. 2-12. Effect of Shift Display on image

NOTE 4

Function Reset resets the following:

Slant, Shift, Locate generator on, Frame generator on, Augment on, and Auto Erase.

NOTE 5

When the VIEW and Write-Thru commands are issued the devices selected go into these states. A device may be reset by disconnecting the device and then re-selecting it or by using Function Reset or Initial. Commands referring to the lower half of the screen apply only to split screen storage oscilloscopes such as the Tektronix Type 549. On such oscilloscopes other commands generally apply only to the upper half of the screen.

NOTES

SECTION 3
SERVICING

Change information, if any, affecting this section will be found at the rear of the manual.

Introduction

This section of the manual contains servicing information for use in preventive maintenance, corrective maintenance and troubleshooting.

The Interface Area is the right rear section of the 4201 Drawer Unit. Space is provided in this area for six circuit cards, although only four cards are required to interface with the IBM 1130.

Slide-Out Drawer Removal

WARNING

Dangerous potentials exist at several points throughout this instrument. When the instrument is operated with the Drawer Unit open or removed, do not touch exposed connections or components. Disconnect power before cleaning the instrument or replacing parts.

To slide out or remove the Drawer Unit, loosen the four screws at the rear of the unit. Disconnect the power cord and connecting cable from the Display Unit and pull the Drawer outward until the stop latches catch. Press the stop latches and remove by pulling the Drawer Unit outward.

PREVENTIVE MAINTENANCE

General

Preventive maintenance consists of cleaning, visual inspection, etc. Preventive maintenance performed on a regular basis may prevent instrument breakdown and will improve the reliability of this instrument. The severity of the environment to which it is subjected determines the frequency of maintenance.

Cleaning

Dust in the interior of the instrument should be removed occasionally due to its electrical conductivity under high-humidity conditions. The best way to clean the interior is to blow off the accumulated dust with dry, low-pressure air. Remove any dirt which remains with a soft paint brush or a cloth dampened with a mild detergent and water solution. A cotton-tipped applicator is useful for cleaning in narrow spaces.

Visual Inspection

The unit should be inspected occasionally for such defects as broken connections, damaged or improperly installed circuit boards and heat-damaged parts.

The corrective procedure for most visible defects is obvious; however, particular care must be taken if heat-damaged components are found. Overheating usually indicates other trouble in the unit. It is important that the cause of overheating be corrected to prevent recurrence of the damage.

TROUBLESHOOTING

Introduction

The following information is provided to facilitate troubleshooting of the Interface Unit. Information contained in other sections of this manual should be used with the following information to aid in locating the defective component.

Troubleshooting Aids

Diagrams. Complete circuit diagrams are given on fold-out pages in the Diagrams Section. The component number and electrical value of each component in this unit are shown on the diagrams.

Schematics are arranged in the order that is used in describing the circuits in the Circuit Description Section.

An assembly number (A1, A2, etc.) is shown below each schematic diagram. The assembly number is used to interrelate the circuit card, schematic diagram, Electrical Parts List, and Mechanical Parts List. Assembly numbers in the parts list are in numerical order.

Component Location. Photographs of Interface Cards, IF-1 through IF-4, are on the same sheet as the applicable schematic diagram. Pin numbers of connectors on these cards and components are identified on these photographs.

CORRECTIVE MAINTENANCE

General

Corrective maintenance consists of component replacement and instrument repair. Special techniques required to replace components in this instrument are given here.

Component Replacement

WARNING

Disconnect the equipment from the power source before replacing components.

General. The exploded-view drawings associated with the Mechanical Parts List (located after the diagram section on pull-out pages) may be helpful in the removal or disassembly of individual components or sub-assemblies.

Circuit Board Replacement. If a circuit board is damaged beyond repair, the entire assembly including all soldered-on components can be replaced. Part numbers are given in the Mechanical Parts List.

Semiconductor Replacement. Replacement semiconductors should be of the original type or a direct replacement. All transistor sockets are wired for the standard basing as used for metal-case transistors. If a replacement transistor is made by a different manufacturer than the original, check the manufacturer's basing diagram for correct basing.

Obtaining Replacement Parts

Standard Parts. All electrical and mechanical part replacements may be obtained through your local Tektronix Field Office or representative. However, many of the standard electronic components can be obtained locally in less time than is required to order them from Tektronix, Inc. Before purchasing or ordering replacement parts, check the parts list for value, tolerance, rating, and description. All replacement parts should be direct replacements unless it is known that a different component will not adversely affect instrument performance.

Special Parts. In addition to the standard electronic components, some special parts are used in this instrument. These parts are manufactured or selected by Tektronix, Inc. to meet specific performance requirements, or are manufactured for Tektronix Inc. in accordance with our specifications. These special parts are indicated in the Electrical Parts List by an asterisk preceding the part number. Most of the mechanical parts have been manufactured by Tektronix, Inc. Order all special parts directly from your local Tektronix Field Office or representative.

Ordering Parts. When ordering replacement parts from Tektronix, Inc., include the following information:

1. Instrument Type.

2. Instrument Serial Number.

3. A description of the part (if electrical, include circuit number).

4. Tektronix Part Number.

INTERCONNECTIONS

All lines between the 015-0180-00 Interface Unit and the IBM 1130 pass through the ten connectors (J110 through J114 and J120 through J124) located along the right side of the Interface Interconnect Board (see Fig. 3-1). Connector and pin numbers for signal lines between the IBM 1130 and the Interface Unit are given under the heading of Interface Connections in Section 1.

All lines between the Interface Unit and the Graphic Area, Accessory Area or Control Panel of the 4201 GDC pass through the four connectors (J130, J131, J132, or J133) located along the left side of the Interface Interconnect board. Pin numbers for these connectors, signal name, and To/From information are listed in Table 3-1. When leads of the Interface schematics are referenced to connectors J130 through J133 consult Table 3-1, since in these cases leads go to more than one place.

Numbers within a diamond (<23>), in Table 3-1, refer to schematic diagram numbers in the T4005/4201 Maintenance manual.

Essentially the same interconnection information shown in Table 3-1 may be found, under the heading of 4201 INPUT/OUTPUT INTERFACE BUS, in Section 1 of the T4005/4201 Maintenance manual.

The block diagram shown in Fig. 3-2 represents interconnections between the Interface, Computer, and GDC.

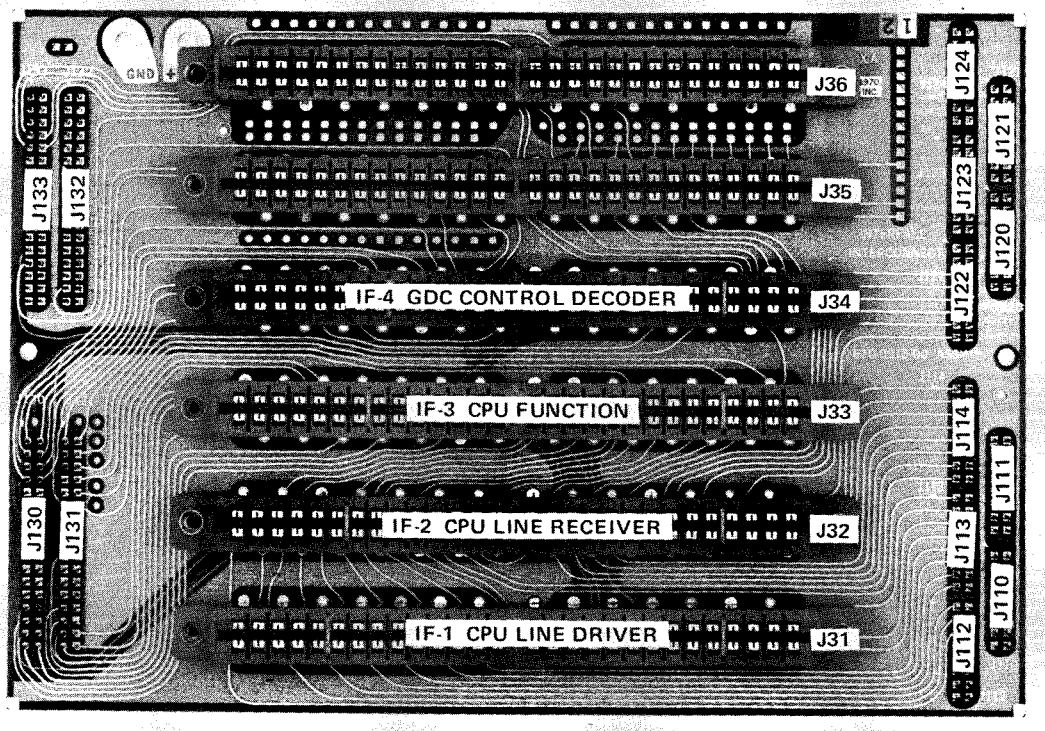


Fig. 3-1. Interface Interconnect Board.

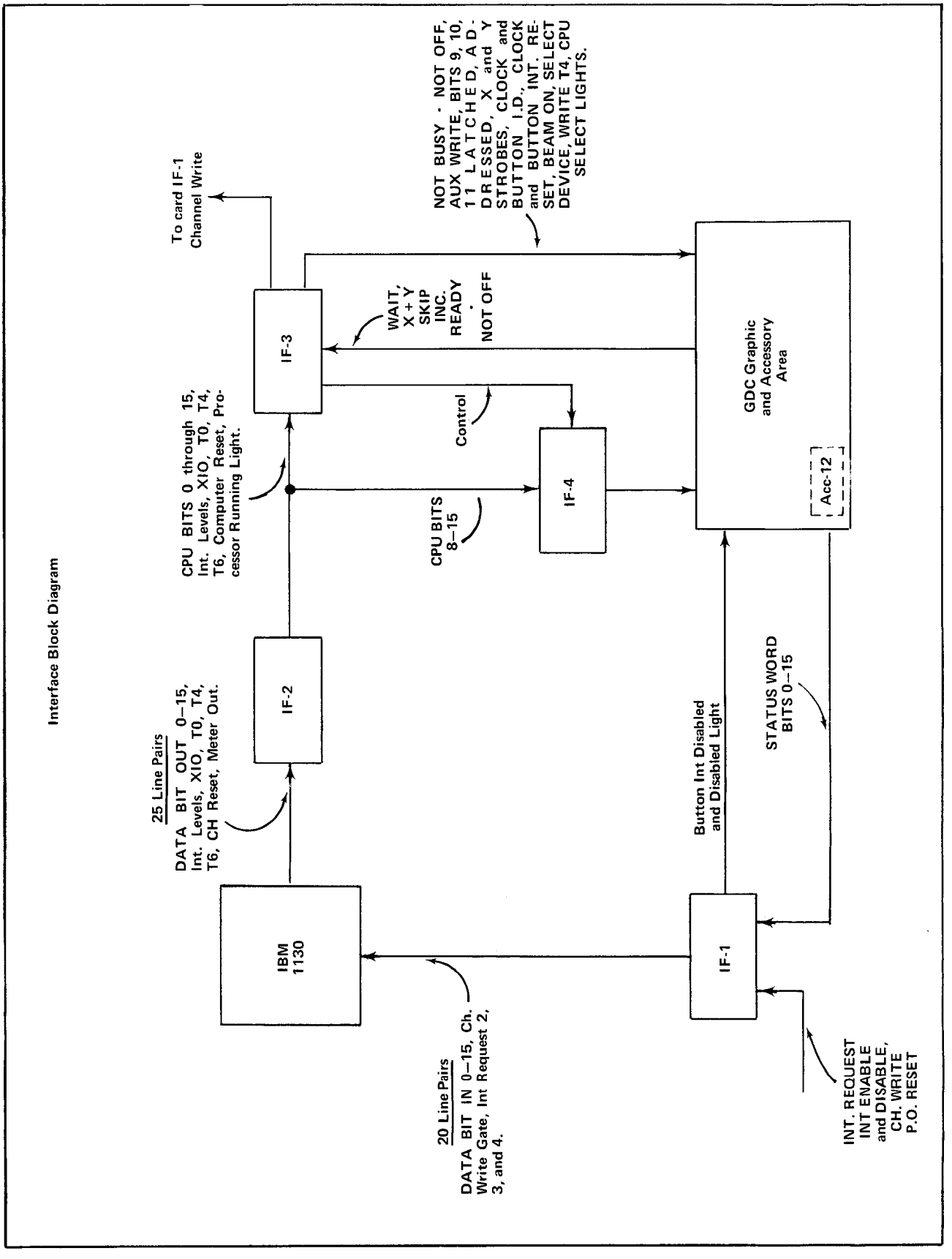


Fig. 3-2. Relationship of Interface cards IF-1, IF-2, IF-3, and IF-4 to the IBM 1130 Computer and 4201 GDC.

TABLE 3-1

Interface to GDC Interconnections

J130 and J230

Pin	Signal Name	To/From
1	CONDITIONAL ERASE	J34-N to J1A-M ◇2
2	AUTO ERASE SET	J34-P to J1A-5 ◇2
3	LOCATOR GEN ON	J34-12 to J7B-19 ◇23
4	SLANT	J34-13 to J7B-2 ◇23
5	X + Y SKIP INC.	J4A-U ◇20 to J33-M and J15, 16, 17, 18-Z ◇30
6	READY · NOT OFF	J7A-T ◇23 to J33-10
7	WRITE T4 (SETUP)	J33-12 to J1B-4 ◇2
8		J34-18 to Accessory Area
9		J34-16 to Accessory Area
10		
11	ACC INTERRUPT REQUEST	J31-16 to Accessory Area
12		
13	P.O. RESET	J7B-5 ◇24 to J31-26, J15, 16, 17, or J18-26 ◇30
14	CPU RESET	J32-E to { J1B-A ◇2 ; J14-8 ◇28 }
15	CLOCK INTERRUPT REQUEST	J7B-10 ◇23 to { J31-18 ; J33-15 }
16	P.O. RESET + INITIAL	J1B-72 to { J33-13 ; J2A-11 } ◇4 J4A-C ◇20 J7B-B ◇23 ; J6A-11 ◇9 J14-B ◇29
17	WAIT	J7A-4 ◇24 to J33-8
18	UNCONDITIONAL ERASE	J34-M to J1A-11 ◇2
19	FRAME GEN ON	J34-11 to J7B-17 ◇23
20	FUNCTION RESET	J34-J to J7B-D ◇23
21	VERT AUG	J34-H to J1A-23 ◇2
22	LOCATE MODE	J34-10 to J1A-18 ◇2
23	FRAME MODE	J34-9 to J1A-1 ◇2
24	READY MODE	J34-8 to J1A-A ◇2
25		
26		
27		

TABLE 3-1 (cont)

J130 and J230 (cont)

Pin	Signal Name	To/From
28		J34-20 to Accessory Area
29		
30		
31	–Y Strobe	J33-7 to J5A-7 ◇17◇
32	$\overline{\text{PROCESSOR RUNNING LIGHT}}$	J32-K to J125D-3 ◇1◇
33	$\overline{\text{INTERRUPT DISABLE LIGHT}}$	J31-FF to J125-B-8 ◇1◇
34	BEAM ON	J33-6 to J4B-H ◇20◇

J131 and J231

Pin	Signal Name	To/From
1	$\overline{\text{VERT 8 K}}$	J34-F to J6A-24 ◇9◇
2	$\overline{\text{HORIZ AUG}}$	J34-7 to J1B-8 ◇2◇
3	$\overline{\text{VERT 4 K}}$	J34-E to J6A-22 ◇9◇
4	$\overline{\text{VERT 2 K}}$	J34-D to J6A-Y ◇9◇
5		
6	$\overline{\text{SOFTWARE INITIAL}}$	J34-15 to J1B-C ◇2◇
7		
8		
9		
10	$\overline{\text{ACC INTERRUPT LEVEL}}$	J32B to Accessory spares
11	$\overline{\text{VERT 256}}$	J34-A to J6A-EE ◇9◇
12	$\overline{\text{VERT 1 K}}$	J34-C to J6A-AA ◇9◇
13	$\overline{\text{VERT 512}}$	J34-B to J6A-BB ◇9◇
14	SKIP	J33-4 to J3A-K ◇15◇ / J5A-K ◇18◇
15	CPU Bit 9 LATCHED	J33-5 to J7A-FF ◇24◇
16	$\overline{\text{AUX WRITE}}$	J33-B to J7A-EE ◇24◇
17	CPU Bit 11 LATCHED	J33-D to J7A-28 ◇24◇
18	$\overline{\text{SHIFT}}$	J34-14 to J7B-A ◇23◇
19	$\overline{\text{CLOCK DISABLE}}$	J34-BB to J7B-7 ◇23◇

TABLE 3-1 (cont)

J131 and J231 (cont)

Pin	Signal Name	To/From
20	$\overline{\text{CLOCK ENABLE}}$	J34-CC to J7B-8 ◇23◇
21	ADDRESSED	J33-EE to J7A-B ◇24◇
22	CLOCK INTERRUPT RESET	J33-CC to J7B-F ◇23◇
23	$\overline{\text{CPU SELECT LIGHTS}}$	J33-X to J1A-24 ◇2◇
24	$\overline{\text{HORIZ 256}}$	J34-1 to J2A-EE ◇4◇
25	$\overline{\text{HORIZ 1 K}}$	J34-3 to J2A-AA ◇4◇
26	$\overline{\text{HORIZ 512}}$	J34-2 to J2A-BB ◇4◇
27	$\overline{\text{HORIZ 2 K}}$	J34-4 to J2A-Y ◇4◇
28	$\overline{\text{HORIZ 4 K}}$	J34-5 to J2A-22 ◇4◇
29	$\overline{\text{HORIZ 8 K}}$	J34-6 to J2A-24 ◇4◇
30	+ X Strobe	J33-J to J3A-9 ◇14◇
31	− X Strobe	J33-H to J3A-7 ◇14◇
32	SETTING UP	J7A-5 ◇23◇ to J33-9 and J3A-BB ◇15◇, J5A-BB ◇18◇
33	CPU Bit 10 LATCHED	J33-E to J7A-27 ◇24◇
34	+ Y Strobe	J33-F to J5A-9 ◇17◇

J132 and J232

Pin	Signal Name	To/From
1	$\overline{\text{SELECT STATUS WORD}}$	J33-Y to J22-25B ◇35◇
2		
3		
4		
5		
6		
7	$\overline{\text{STATUS WORD BIT 17}}$	Not used
8		
9		
10	$\overline{\text{STATUS WORD BIT 21}}$	Not used
11		
12		
13		

TABLE 3-1 (cont)

J132 and J232 (cont)

Pin	Signal Name	To/From
14	CPU BIT 14	J32-EE to J33-17 J14-2 (28); J34-26 J18-18 (30)
15	CPU BIT 12	J32-CC to J33-L J14-3 (28); J34-24 J17-18 (30)
16	CPU BIT 8	J32-Y to J33-3 J14-10 (28) J15-18 (30); J34-DD J22-49A (35)
17	$\overline{\text{STATUS WORD BIT 7}}$	J22-41A (36) to J31-7
18	CPU BIT 13	J32-DD to J33-K J14-C (28); J34-25 J17-21 (30)
19	$\overline{\text{SELECT DEVICES}}$	J33-W to J15, 16, 17, 18-25 (30)
20	BUTTON INTERRUPT REQUEST	J14-9 (29) to J31-17, J33-18
21	$\overline{\text{CLOCK INT I.D. BIT}}$	J33-P to J22-31B (36)
22		J34-22 to Accessory Area
23	$\overline{\text{BUTTON INT I.D. BIT}}$	J33-N to J22-30B (36)
24	READY · NOT BUSY · NOT OFF	J33-11 to J21-7 (34)
25	BUTTON INTERRUPT DISABLED	J31-25 to J21-14 (34)
26	$\overline{\text{STATUS WORD BIT 0}}$	J22-48A (36) to J31-23
27	$\overline{\text{STATUS WORD BIT 15}}$	J22-33A (36) to J31-22
28	$\overline{\text{STATUS WORD BIT 14}}$	J22-34A (36) to J31-21
29	$\overline{\text{STATUS WORD BIT 13}}$	J22-35A (36) to J31-20
30	$\overline{\text{STATUS WORD BIT 12}}$	J22-36A (36) to J31-12
31	$\overline{\text{STATUS WORD BIT 11}}$	J22-37A (36) to J31-11
32	$\overline{\text{STATUS WORD BIT 10}}$	J22-38A (36) to J31-10
33	$\overline{\text{STATUS WORD BIT 9}}$	J22-39A (36) to J31-9
34	$\overline{\text{STATUS WORD BIT 8}}$	J22-40A (36) to J31-8

J133 and J233

Pin	Signal Name	To/From
1	BUTTON INTERRUPT RESET	J33-BB to J14-A (29)
2	$\overline{\text{LOWER SCREEN NON-STORE}}$	J34-T to J18-FF — Not used with Option 1
3	$\overline{\text{LOWER SCREEN ERASE}}$	J34-U to J18-28 — Not used with Option 1

TABLE 3-1 (cont)

J133 and J233 (cont)

Pin	Signal Name	To/From
4	CPU Bit 10	J32-AA to J33-1 J14-12 ◇28◇ J16-18 ◇30◇ / J34-FF J22-49B ◇35◇
5	CPU Bit 11	J32-BB to J33-A J14-13 ◇28◇ J16-21 ◇30◇ / J34-28 J22-50B ◇35◇
6		J34-19 to Accessory Area
7		J34-21 to Accessory Area
8		J34-W to Accessory Area
9		J34-V to Accessory Area
10		J34-17 to Accessory Area
11		J34-X to Accessory Area
12		J34-Y to Accessory Area
13	$\overline{\text{ACC INT REQ and INT LEVEL}}$	Accessory spares to J33-C
14	$\overline{\text{ACC INT ID BIT}}$	J33-V to J13-B
15	$\overline{\text{STATUS WORD BIT 1}}$	J22-47A to J31-1
16	$\overline{\text{STATUS WORD BIT 2}}$	J22-46A to J31-2
17	$\overline{\text{STATUS WORD BIT 3}}$	J22-45A to J31-3
18	STATUS WORD RESET	J33-AA to J22-21B ◇35◇
19	$\overline{\text{WRITE THROUGH}}$	J34-L to J15, 16, 17, 18-Y ◇30◇
20	VIEW	J34-K to J15, 16, 17, 18-X ◇30◇
21	CPU Bit 9	J32-Z to { J34-EE J14-11 ◇28◇ J15-21 ◇30◇ / J33-2 J22-50A }
22	CPU Bit 15	J32-FF to { J33-14 J14-1 ◇28◇ / J34-27 J18-21 ◇30◇ }
23	$\overline{\text{STATUS WORD BIT 23}}$	Not used
24	$\overline{\text{STATUS WORD BIT 16}}$	Not used
25	$\overline{\text{STATUS WORD BIT 19}}$	Not used
26	$\overline{\text{STATUS WORD BIT 22}}$	Not used
27	$\overline{\text{STATUS WORD BIT 18}}$	Not used
28	$\overline{\text{STATUS WORD BIT 20}}$	Not used
29		
30		

TABLE 3-1 (cont)

J133 and J233 (cont)

Pin	Signal Name	To/From
31		
32	$\overline{\text{STATUS WORD BIT 6}}$	J22-42A to J31-6
33	$\overline{\text{STATUS WORD BIT 5}}$	J22-43A to J31-5
34	$\overline{\text{STATUS WORD BIT 4}}$	J22-44A to J31-4

PARTS LIST ABBREVIATIONS

BHB	binding head brass
BHS	binding head steel
cap.	capacitor
cer	ceramic
comp	composition
conn	connector
CRT	cathode-ray tube
csk	countersunk
DE	double end
dia	diameter
div	division
elect.	electrolytic
EMC	electrolytic, metal cased
EMT	electrolytic, metal tubular
ext	external
F & I	focus and intensity
FHB	flat head brass
FHS	flat head steel
Fil HB	fillister head brass
Fil HS	fillister head steel
h	height or high
hex.	hexagonal
HHB	hex head brass
HHS	hex head steel
HSB	hex socket brass
HSS	hex socket steel
ID	inside diameter
inc	incandescent
int	internal
lg	length or long
met.	metal
mtg hdw	mounting hardware
OD	outside diameter
OHB	oval head brass
OHS	oval head steel
P/O	part of
PHB	pan head brass
PHS	pan head steel
plstc	plastic
PMC	paper, metal cased
poly	polystyrene
prec	precision
PT	paper, tubular
PTM	paper or plastic, tubular, molded
RHB	round head brass
RHS	round head steel
SE	single end
SN or S/N	serial number
S or SW	switch
TC	temperature compensated
THB	truss head brass
thk	thick
THS	truss head steel
tub.	tubular
var	variable
w	wide or width
WW	wire-wound

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial or model number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

SPECIAL NOTES AND SYMBOLS

X000	Part first added at this serial number
00X	Part removed after this serial number
*000-0000-00	Asterisk preceding Tektronix Part Number indicates manufactured by or for Tektronix, Inc., or reworked or checked components.
Use 000-0000-00	Part number indicated is direct replacement.

INDEX OF ELECTRICAL PARTS LIST

SECTION 4
ELECTRICAL PARTS LIST

Values are fixed unless marked Variable.

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description		
				CHASSIS		
				Capacitor		
Tolerance ±20% unless otherwise indicated.						
C154	283-0177-00		1 μF	Cer	25 V	+80%—20%
				Resistor		
Resistors are fixed, composition, ±10% unless otherwise indicated.						
R154	315-0470-00		47 Ω	1/4 W		5%
				Switch		
	Wired or Unwired					
S154	260-0450-00		Slide			
				A1 IF1 CPU LINE DRIVER Circuit Card Assembly		
	*670-0930-00			Complete Card		
				Capacitors		
Tolerance ±20% unless otherwise indicated.						
C13	283-0194-00		4.7 μF	Cer	50 V	
C16	283-0194-00		4.7 μF	Cer	50 V	
C17	283-0194-00		4.7 μF	Cer	50 V	
C97	283-0059-00		1 μF	Cer	25 V	+80%—20%
C99	290-0297-00		39 μF	Elect.	10 V	10%
				Semiconductor Device, Diodes		
CR10	*152-0075-00		Germanium	Tek Spec		
CR13	*152-0185-00		Silicon	Replaceable by 1N4152		
CR17	*152-0185-00		Silicon	Replaceable by 1N4152		
CR18	*152-0185-00		Silicon	Replaceable by 1N4152		
CR20	*152-0075-00		Germanium	Tek Spec		

A1 IF1 CPU LINE DRIVER Circuit Card Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
		Semiconductor Device, Diodes (cont)		
CR21	*152-0185-00		Silicon	Replaceable by 1N4152
CR23	*152-0185-00		Silicon	Replaceable by 1N4152
CR24	*152-0185-00		Silicon	Replaceable by 1N4152
CR25	*152-0075-00		Germanium	Tek Spec
CR26	*152-0185-00		Silicon	Replaceable by 1N4152
CR27	*152-0185-00		Silicon	Replaceable by 1N4152
CR29	*152-0185-00		Silicon	Replaceable by 1N4152
CR30	*152-0185-00		Silicon	Replaceable by 1N4152
CR31	*152-0185-00		Silicon	Replaceable by 1N4152
CR34	*152-0185-00		Silicon	Replaceable by 1N4152
CR35	*152-0185-00		Silicon	Replaceable by 1N4152
CR38	*152-0185-00		Silicon	Replaceable by 1N4152
CR39	*152-0185-00		Silicon	Replaceable by 1N4152
CR42	*152-0185-00		Silicon	Replaceable by 1N4152
CR43	*152-0185-00		Silicon	Replaceable by 1N4152
CR46	*152-0185-00		Silicon	Replaceable by 1N4152
CR47	*152-0185-00		Silicon	Replaceable by 1N4152
CR50	*152-0185-00		Silicon	Replaceable by 1N4152
CR51	*152-0185-00		Silicon	Replaceable by 1N4152
CR54	*152-0185-00		Silicon	Replaceable by 1N4152
CR55	*152-0185-00		Silicon	Replaceable by 1N4152
CR58	*152-0185-00		Silicon	Replaceable by 1N4152
CR59	*152-0185-00		Silicon	Replaceable by 1N4152
CR62	*152-0185-00		Silicon	Replaceable by 1N4152
CR63	*152-0185-00		Silicon	Replaceable by 1N4152
CR66	*152-0185-00		Silicon	Replaceable by 1N4152
CR67	*152-0185-00		Silicon	Replaceable by 1N4152
CR70	*152-0185-00		Silicon	Replaceable by 1N4152
CR71	*152-0185-00		Silicon	Replaceable by 1N4152
CR74	*152-0185-00		Silicon	Replaceable by 1N4152
CR75	*152-0185-00		Silicon	Replaceable by 1N4152
CR78	*152-0185-00		Silicon	Replaceable by 1N4152
CR79	*152-0185-00		Silicon	Replaceable by 1N4152
CR82	*152-0185-00		Silicon	Replaceable by 1N4152
CR83	*152-0185-00		Silicon	Replaceable by 1N4152
CR86	*152-0185-00		Silicon	Replaceable by 1N4152
CR87	*152-0185-00		Silicon	Replaceable by 1N4152
CR90	*152-0185-00		Silicon	Replaceable by 1N4152
CR91	*152-0185-00		Silicon	Replaceable by 1N4152
CR94	*152-0185-00		Silicon	Replaceable by 1N4152
CR95	*152-0185-00		Silicon	Replaceable by 1N4152

A1 IF1 CPU LINE DRIVER Circuit Card Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description			
				Relay			
K18	148-0064-00			Resonant reed, spst, 500 Ω, 5 V			
				Transistors			
Q14	151-0188-00			Silicon	PNP	TO-92	2N3906
Q16	151-0503-00			SCR		30 V	2N5060
Q18	151-0254-00			Silicon	NPN	TO-98	2N5308
Q19	151-0207-00			Silicon	NPN	TO-98	2N3415
Q21	151-0223-00			Silicon	NPN	TO-18	2N4275
Q22	151-0207-00			Silicon	NPN	TO-98	2N3415
Q24	151-0223-00			Silicon	NPN	TO-18	2N4275
Q27	151-0223-00			Silicon	NPN	TO-18	2N4275
Q28	151-0254-00			Silicon	NPN	TO-98	2N5308
Q29	151-0223-00			Silicon	NPN	TO-18	2N4275
Q31	151-0223-00			Silicon	NPN	TO-18	2N4275
Q35	151-0223-00			Silicon	NPN	TO-18	2N4275
Q39	151-0223-00			Silicon	NPN	TO-18	2N4275
Q43	151-0223-00			Silicon	NPN	TO-18	2N4275
Q47	151-0223-00			Silicon	NPN	TO-18	2N4275
Q51	151-0223-00			Silicon	NPN	TO-18	2N4275
Q55	151-0223-00			Silicon	NPN	TO-18	2N4275
Q59	151-0223-00			Silicon	NPN	TO-18	2N4275
Q63	151-0223-00			Silicon	NPN	TO-18	2N4275
Q67	151-0223-00			Silicon	NPN	TO-18	2N4275
Q71	151-0223-00			Silicon	NPN	TO-18	2N4275
Q75	151-0223-00			Silicon	NPN	TO-18	2N4275
Q79	151-0223-00			Silicon	NPN	TO-18	2N4275
Q83	151-0223-00			Silicon	NPN	TO-18	2N4275
Q87	151-0223-00			Silicon	NPN	TO-18	2N4275
Q91	151-0223-00			Silicon	NPN	TO-18	2N4275
Q95	151-0223-00			Silicon	NPN	TO-18	2N4275
				Resistors			
Resistors are fixed, composition, ±10% unless otherwise indicated.							
R4	316-0103-00			10 kΩ	1/4 W		
R5	316-0102-00			1 kΩ	1/4 W		
R7	316-0103-00			10 kΩ	1/4 W		
R8	316-0102-00			1 kΩ	1/4 W		
R10	316-0102-00			1 kΩ	1/4 W		

A1 IF1 CPU LINE DRIVER Circuit Card Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
		Resistors (cont)		
R12	316-0101-00		100 Ω	1/4 W
R13	316-0473-00		47 kΩ	1/4 W
R14	316-0101-00		100 Ω	1/4 W
R15	316-0103-00		10 kΩ	1/4 W
R16	316-0104-00		100 kΩ	1/4 W
R17	316-0104-00		100 kΩ	1/4 W
R19	316-0153-00		15 kΩ	1/4 W
R20	316-0102-00		1 kΩ	1/4 W
R21	316-0103-00		10 kΩ	1/4 W
R22	316-0153-00		15 kΩ	1/4 W
R23	316-0102-00		1 kΩ	1/4 W
R24	316-0103-00		10 kΩ	1/4 W
R25	316-0102-00		1 kΩ	1/4 W
R26	316-0102-00		1 kΩ	1/4 W
R27	316-0103-00		10 kΩ	1/4 W
R28	316-0103-00		10 kΩ	1/4 W
R29	316-0103-00		10 kΩ	1/4 W
R30	316-0102-00		1 kΩ	1/4 W
R31	316-0103-00		10 kΩ	1/4 W
R34	316-0102-00		1 kΩ	1/4 W
R35	316-0103-00		10 kΩ	1/4 W
R38	316-0102-00		1 kΩ	1/4 W
R39	316-0103-00		10 kΩ	1/4 W
R42	316-0102-00		1 kΩ	1/4 W
R43	316-0103-00		10 kΩ	1/4 W
R46	316-0102-00		1 kΩ	1/4 W
R47	316-0103-00		10 kΩ	1/4 W
R50	316-0102-00		1 kΩ	1/4 W
R51	316-0103-00		10 kΩ	1/4 W
R54	316-0102-00		1 kΩ	1/4 W
R55	316-0103-00		10 kΩ	1/4 W
R58	316-0102-00		1 kΩ	1/4 W
R59	316-0103-00		10 kΩ	1/4 W
R62	316-0102-00		1 kΩ	1/4 W
R63	316-0103-00		10 kΩ	1/4 W
R66	316-0102-00		1 kΩ	1/4 W
R67	316-0103-00		10 kΩ	1/4 W
R70	316-0102-00		1 kΩ	1/4 W
R71	316-0103-00		10 kΩ	1/4 W
R74	316-0102-00		1 kΩ	1/4 W

A1 IF1 CPU LINE DRIVER Circuit Card Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
		Resistors (cont)		
R75	316-0103-00		10 kΩ	1/4 W
R78	316-0102-00		1 kΩ	1/4 W
R79	316-0103-00		10 kΩ	1/4 W
R82	316-0102-00		1 kΩ	1/4 W
R83	316-0103-00		10 kΩ	1/4 W
R86	316-0102-00		1 kΩ	1/4 W
R87	316-0103-00		10 kΩ	1/4 W
R90	316-0102-00		1 kΩ	1/4 W
R91	316-0103-00		10 kΩ	1/4 W
R94	316-0102-00		1 kΩ	1/4 W
R95	316-0103-00		10 kΩ	1/4 W
R97	316-0100-00		10 Ω	1/4 W
		Integrated Circuit		
U2	156-0034-00		Dual 4-input gate. Replaceable by T.I. SN7420N	

A2 IF2 CPU LINE RECEIVER Circuit Card Assembly

*670-0929-00 Complete Card

Capacitor

Tolerance ±20% unless otherwise indicated.

C288	290-0138-00	330 μF	Elect.	6 V

Semiconductor Device, Diodes

CR13	*152-0075-00	Germanium	Tek Spec
CR14	*152-0185-00	Silicon	Replaceable by 1N4152
CR23	*152-0075-00	Germanium	Tek Spec
CR24	*152-0185-00	Silicon	Replaceable by 1N4152
CR33	*152-0075-00	Germanium	Tek Spec
CR34	*152-0185-00	Silicon	Replaceable by 1N4152
CR43	*152-0075-00	Germanium	Tek Spec
CR44	*152-0185-00	Silicon	Replaceable by 1N4152
CR53	*152-0075-00	Germanium	Tek Spec
CR54	*152-0185-00	Silicon	Replaceable by 1N4152

A2 IF2 CPU LINE RECEIVER Circuit Card Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
		Semiconductor Device, Diodes (cont)		
CR63	*152-0075-00		Germanium	Tek Spec
CR64	*152-0185-00		Silicon	Replaceable by 1N4152
CR73	*152-0075-00		Germanium	Tek Spec
CR74	*152-0185-00		Silicon	Replaceable by 1N4152
CR83	*152-0075-00		Germanium	Tek Spec
CR84	*152-0185-00		Silicon	Replaceable by 1N4152
CR93	*152-0075-00		Germanium	Tek Spec
CR94	*152-0185-00		Silicon	Replaceable by 1N4152
CR103	*152-0075-00		Germanium	Tek Spec
CR104	*152-0185-00		Silicon	Replaceable by 1N4152
CR113	*152-0075-00		Germanium	Tek Spec
CR114	*152-0185-00		Silicon	Replaceable by 1N4152
CR123	*152-0075-00		Germanium	Tek Spec
CR124	*152-0185-00		Silicon	Replaceable by 1N4152
CR153	*152-0075-00		Germanium	Tek Spec
CR154	*152-0185-00		Silicon	Replaceable by 1N4152
CR163	*152-0075-00		Germanium	Tek Spec
CR164	*152-0185-00		Silicon	Replaceable by 1N4152
CR173	*152-0075-00		Germanium	Tek Spec
CR174	*152-0185-00		Silicon	Replaceable by 1N4152
CR183	*152-0075-00		Germanium	Tek Spec
CR184	*152-0185-00		Silicon	Replaceable by 1N4152
CR193	*152-0075-00		Germanium	Tek Spec
CR194	*152-0185-00		Silicon	Replaceable by 1N4152
CR203	*152-0075-00		Germanium	Tek Spec
CR204	*152-0185-00		Silicon	Replaceable by 1N4152
CR213	*152-0075-00		Germanium	Tek Spec
CR214	*152-0185-00		Silicon	Replaceable by 1N4152
CR223	*152-0075-00		Germanium	Tek Spec
CR224	*152-0185-00		Silicon	Replaceable by 1N4152
CR233	*152-0075-00		Germanium	Tek Spec
CR234	*152-0185-00		Silicon	Replaceable by 1N4152
CR243	*152-0075-00		Germanium	Tek Spec
CR244	*152-0185-00		Silicon	Replaceable by 1N4152
CR253	*152-0075-00		Germanium	Tek Spec
CR254	*152-0185-00		Silicon	Replaceable by 1N4152
CR263	*152-0075-00		Germanium	Tek Spec
CR264	*152-0185-00		Silicon	Replaceable by 1N4152
CR273	*152-0075-00		Germanium	Tek Spec
CR274	*152-0185-00		Silicon	Replaceable by 1N4152
CR283	*152-0075-00		Germanium	Tek Spec
CR284	*152-0185-00		Silicon	Replaceable by 1N4152

A2 IF2 CPU LINE RECEIVER Circuit Card Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description		
			Transistors			
Q16	151-0223-00		Silicon	NPN	TO-18	2N4275
Q26	151-0223-00		Silicon	NPN	TO-18	2N4275
Q36	151-0223-00		Silicon	NPN	TO-18	2N4275
Q46	151-0223-00		Silicon	NPN	TO-18	2N4275
Q56	151-0223-00		Silicon	NPN	TO-18	2N4275
Q66	151-0223-00		Silicon	NPN	TO-18	2N4275
Q76	151-0223-00		Silicon	NPN	TO-18	2N4275
Q86	151-0223-00		Silicon	NPN	TO-18	2N4275
Q96	151-0223-00		Silicon	NPN	TO-18	2N4275
Q98	151-0254-00		Silicon	NPN	TO-98	2N5308
Q106	151-0223-00		Silicon	NPN	TO-18	2N4275
Q116	151-0223-00		Silicon	NPN	TO-18	2N4275
Q126	151-0223-00		Silicon	NPN	TO-18	2N4275
Q156	151-0223-00		Silicon	NPN	TO-18	2N4275
Q166	151-0223-00		Silicon	NPN	TO-18	2N4275
Q176	151-0223-00		Silicon	NPN	TO-18	2N4275
Q186	151-0223-00		Silicon	NPN	TO-18	2N4275
Q196	151-0223-00		Silicon	NPN	TO-18	2N4275
Q206	151-0223-00		Silicon	NPN	TO-18	2N4275
Q216	151-0223-00		Silicon	NPN	TO-18	2N4275
Q226	151-0223-00		Silicon	NPN	TO-18	2N4275
Q236	151-0223-00		Silicon	NPN	TO-18	2N4275
Q246	151-0223-00		Silicon	NPN	TO-18	2N4275
Q256	151-0223-00		Silicon	NPN	TO-18	2N4275
Q266	151-0223-00		Silicon	NPN	TO-18	2N4275
Q276	151-0223-00		Silicon	NPN	TO-18	2N4275
Q286	151-0223-00		Silicon	NPN	TO-18	2N4275

Resistors

Resistors are fixed, composition, ±10% unless otherwise indicated.

R11	315-0161-00	160 Ω	1/4 W	5%
R12	315-0241-00	240 Ω	1/4 W	5%
R13	316-0222-00	2.2 kΩ	1/4 W	
R14	316-0103-00	10 kΩ	1/4 W	
R16	316-0102-00	1 kΩ	1/4 W	
R21	315-0161-00	160 Ω	1/4 W	5%
R22	315-0241-00	240 Ω	1/4 W	5%
R23	316-0222-00	2.2 kΩ	1/4 W	
R24	316-0103-00	10 kΩ	1/4 W	
R26	316-0102-00	1 kΩ	1/4 W	

A2 IF2 CPU LINE RECEIVER Circuit Card Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description	
			Resistors (cont)		
R31	315-0161-00		160 Ω	1/4 W	5%
R32	315-0241-00		240 Ω	1/4 W	5%
R33	316-0222-00		2.2 kΩ	1/4 W	
R34	316-0103-00		10 kΩ	1/4 W	
R36	316-0102-00		1 kΩ	1/4 W	
R41	315-0161-00		160 Ω	1/4 W	5%
R42	315-0241-00		240 Ω	1/4 W	5%
R43	316-0222-00		2.2 kΩ	1/4 W	
R44	316-0103-00		10 kΩ	1/4 W	
R46	316-0102-00		1 kΩ	1/4 W	
R51	315-0161-00		160 Ω	1/4 W	5%
R52	315-0241-00		240 Ω	1/4 W	5%
R53	316-0222-00		2.2 kΩ	1/4 W	
R56	316-0102-00		1 kΩ	1/4 W	
R54	316-0103-00		10 kΩ	1/4 W	
R61	315-0161-00		160 Ω	1/4 W	5%
R62	315-0241-00		240 Ω	1/4 W	5%
R63	316-0222-00		2.2 kΩ	1/4 W	
R64	316-0103-00		10 kΩ	1/4 W	
R66	316-0102-00		1 kΩ	1/4 W	
R71	315-0161-00		160 Ω	1/4 W	5%
R72	315-0241-00		240 Ω	1/4 W	5%
R73	316-0222-00		2.2 kΩ	1/4 W	
R74	316-0103-00		10 kΩ	1/4 W	
R76	316-0102-00		1 kΩ	1/4 W	
R81	315-0161-00		160 Ω	1/4 W	5%
R82	315-0241-00		240 Ω	1/4 W	5%
R83	316-0222-00		2.2 kΩ	1/4 W	
R84	316-0103-00		10 kΩ	1/4 W	
R86	316-0102-00		1 kΩ	1/4 W	
R91	315-0161-00		160 Ω	1/4 W	5%
R92	315-0241-00		240 Ω	1/4 W	5%
R93	316-0222-00		2.2 kΩ	1/4 W	
R94	316-0103-00		10 kΩ	1/4 W	
R96	316-0103-00		10 kΩ	1/4 W	
R101	315-0161-00		160 Ω	1/4 W	5%
R102	315-0241-00		240 Ω	1/4 W	5%
R103	316-0222-00		2.2 kΩ	1/4 W	
R104	316-0103-00		10 kΩ	1/4 W	
R106	316-0102-00		1 kΩ	1/4 W	
R111	315-0161-00		160 Ω	1/4 W	5%
R112	315-0241-00		240 Ω	1/4 W	5%
R113	316-0222-00		2.2 kΩ	1/4 W	
R114	316-0103-00		10 kΩ	1/4 W	
R116	316-0102-00		1 kΩ	1/4 W	

A2 IF2 CPU LINE RECEIVER Circuit Card Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description	
			Resistors (cont)		
R121	315-0161-00		160 Ω	1/4 W	5%
R122	315-0241-00		240 Ω	1/4 W	5%
R123	316-0222-00		2.2 kΩ	1/4 W	
R124	316-0103-00		10 kΩ	1/4 W	
R126	316-0102-00		1 kΩ	1/4 W	
R151	315-0161-00		160 Ω	1/4 W	5%
R152	315-0241-00		240 Ω	1/4 W	5%
R153	316-0222-00		2.2 kΩ	1/4 W	
R154	316-0103-00		10 kΩ	1/4 W	
R156	316-0102-00		1 kΩ	1/4 W	
R161	315-0161-00		160 Ω	1/4 W	5%
R162	315-0241-00		240 Ω	1/4 W	5%
R163	316-0222-00		2.2 kΩ	1/4 W	
R164	316-0103-00		10 kΩ	1/4 W	
R166	316-0102-00		1 kΩ	1/4 W	
R171	315-0161-00		160 Ω	1/4 W	5%
R172	315-0241-00		240 Ω	1/4 W	5%
R173	316-0222-00		2.2 kΩ	1/4 W	
R174	316-0103-00		10 kΩ	1/4 W	
R176	316-0102-00		1 kΩ	1/4 W	
R181	315-0161-00		160 Ω	1/4 W	5%
R182	315-0241-00		240 Ω	1/4 W	5%
R183	316-0222-00		2.2 kΩ	1/4 W	
R184	316-0103-00		10 kΩ	1/4 W	
R186	316-0102-00		1 kΩ	1/4 W	
R191	315-0161-00		160 Ω	1/4 W	5%
R192	315-0241-00		240 Ω	1/4 W	5%
R193	316-0222-00		2.2 kΩ	1/4 W	
R194	316-0103-00		10 kΩ	1/4 W	
R196	316-0102-00		1 kΩ	1/4 W	
R201	315-0161-00		160 Ω	1/4 W	5%
R202	315-0241-00		240 Ω	1/4 W	5%
R203	316-0222-00		2.2 kΩ	1/4 W	
R204	316-0103-00		10 kΩ	1/4 W	
R206	316-0102-00		1 kΩ	1/4 W	
R211	315-0161-00		160 Ω	1/4 W	5%
R212	315-0241-00		240 Ω	1/4 W	5%
R213	316-0222-00		2.2 kΩ	1/4 W	
R214	316-0103-00		10 kΩ	1/4 W	
R216	316-0102-00		1 kΩ	1/4 W	

A2 IF2 CPU LINE RECEIVER Circuit Card Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description	
			Resistors (cont)		
R221	315-0161-00		160 Ω	1/4 W	5%
R222	315-0241-00		240 Ω	1/4 W	5%
R223	316-0222-00		2.2 kΩ	1/4 W	
R224	316-0103-00		10 kΩ	1/4 W	
R226	316-0102-00		1 kΩ	1/4 W	
R231	315-0161-00		160 Ω	1/4 W	5%
R232	315-0241-00		240 Ω	1/4 W	5%
R233	316-0222-00		2.2 kΩ	1/4 W	
R234	316-0103-00		10 kΩ	1/4 W	
R236	316-0102-00		1 kΩ	1/4 W	
R241	315-0161-00		160 Ω	1/4 W	5%
R242	315-0241-00		240 Ω	1/4 W	5%
R243	316-0222-00		2.2 kΩ	1/4 W	
R244	316-0103-00		10 kΩ	1/4 W	
R246	316-0102-00		1 kΩ	1/4 W	
R251	315-0161-00		160 Ω	1/4 W	5%
R252	315-0241-00		240 Ω	1/4 W	5%
R253	316-0222-00		2.2 kΩ	1/4 W	
R254	316-0103-00		10 kΩ	1/4 W	
R256	316-0102-00		1 kΩ	1/4 W	
R261	315-0161-00		160 Ω	1/4 W	5%
R262	315-0241-00		240 Ω	1/4 W	5%
R263	316-0222-00		2.2 kΩ	1/4 W	
R264	316-0103-00		10 kΩ	1/4 W	
R266	316-0102-00		1 kΩ	1/4 W	
R271	315-0161-00		160 Ω	1/4 W	5%
R272	315-0241-00		240 Ω	1/4 W	5%
R273	316-0222-00		2.2 kΩ	1/4 W	
R274	316-0103-00		10 kΩ	1/4 W	
R276	316-0102-00		1 kΩ	1/4 W	
R281	315-0161-00		160 Ω	1/4 W	5%
R282	315-0241-00		240 Ω	1/4 W	5%
R283	316-0222-00		2.2 kΩ	1/4 W	
R284	316-0103-00		10 kΩ	1/4 W	
R286	316-0102-00		1 kΩ	1/4 W	
R288	307-0093-00		1.2 Ω	1/2 W	5%

A3 IF3 CPU FUNCTION DECODER Circuit Card Assembly

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description		
	*670-0931-00			Complete Card		
				Capacitors		
Tolerance ±20% unless otherwise indicated.						
C6	283-0065-00			0.001 μF	Cer 100 V	5%
C16	281-0523-00			100 pF	Cer 350 V	
C80	283-0059-00			1 μF	Cer 25 V	+80%—20%
				Semiconductor Device, Diodes		
CR41	*152-0185-00			Silicon	Replaceable by 1N4152	
CR45	*152-0185-00			Silicon	Replaceable by 1N4152	
CR61	*152-0185-00			Silicon	Replaceable by 1N4152	
				Transistors		
Q40	151-0223-00			Silicon NPN	TO-18	2N4275
Q44	151-0223-00			Silicon NPN	TO-18	2N4275
Q62	151-0223-00			Silicon NPN	TO-18	2N4275
				Resistors		
Resistors are fixed, composition, ±10% unless otherwise indicated.						
R6	316-0101-00			100 Ω	¼ W	
R16	316-0103-00			10 kΩ	¼ W	
R40	315-0621-00			620 Ω	¼ W	5%
R41	316-0331-00			330 Ω	¼ W	
R42	316-0103-00			10 kΩ	¼ W	
R44	315-0621-00			620 Ω	¼ W	5%
R45	316-0331-00			330 Ω	¼ W	
R46	316-0103-00			10 kΩ	¼ W	
R60	315-0621-00			620 Ω	¼ W	5%
R61	316-0331-00			330 Ω	¼ W	
R62	316-0103-00			10 kΩ	¼ W	
R70	316-0102-00			1 kΩ	¼ W	
R71	316-0102-00			1 kΩ	¼ W	

A3 IF3 CPU FUNCTION DECODER Circuit Card Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
		Integrated Circuits		
U2	156-0043-00			Quad 2-input NOR gate. Replaceable by T. I. SN7402N
U4	156-0030-00			Quad 2-input gate. Replaceable by T. I. SN7400N
U6	156-0043-00			Quad 2-input NOR gate. Replaceable by T.I. SN7402N
U8	156-0030-00			Quad 2-input gate. Replaceable by T.I. SN7400N
U10	156-0058-00			Hex invert. Replaceable by T. I. SN7404N
U12	156-0047-00			Triple 3-input gate. Replaceable by T. I. SN7410N
U14	156-0030-00			Quad 2-input gate. Replaceable by T. I. SN7400N
U16	156-0081-00			Retriggerable monostable multivibrator. Replaceable by Fairchild 9601
U18	156-0030-00			Quad 2-input gate. Replaceable by T. I. SN7400N
U20	156-0036-00			Dual 4-input buffer. Replaceable by T. I. SN7440N
U22	156-0042-00			Dual J-K flip-flop. Replaceable by T. I. SN7476N
U24	156-0042-00			Dual J-K flip-flop. Replaceable by T. I. SN7476N
U26	156-0043-00			Quad 2-input NOR gate. Replaceable by T. I. SN7402N
U28	156-0043-00			Quad 2-input NOR gate. Replaceable by T. I. SN7402N
U30	156-0061-00			BCD to dec decoder. Replaceable by T.I. SN7442N
U32	156-0047-00			Triple 3-input gate. Replaceable by T. I. SN7410N
U34	156-0043-00			Quad 2-input NOR gate. Replaceable by T. I. SN7402N
U35	156-0030-00			Quad 2-input gate. Replaceable by T. I. SN7400N
U36	156-0030-00			Quad 2-input gate. Replaceable by T. I. SN7400N
U46	156-0043-00			Quad 2-input NOR gate. Replaceable by T. I. SN7402N
U48	156-0040-00			Quad latch. Replaceable by T. I. SN7475N
U50	156-0061-00			BCD to dec decoder. Replaceable by T. I. SN7442N
U52	156-0030-00			Quad 2-input gate. Replaceable by T. I. SN7400N
U54	156-0043-00			Quad 2-input NOR gate. Replaceable by T. I. SN7402N
U56	156-0058-00			Hex invert. Replaceable by T. I. SN7404N
U58	156-0035-00			8-input gate. Replaceable by T. I. SN7430N
U60	156-0030-00			Quad 2-input gate. Replaceable by T. I. SN7400N
U62	156-0030-00			Quad 2-input gate. Replaceable by T. I. SN7400N
U64	156-0047-00			Triple 3-input gate. Replaceable by T. I. SN7410N

A4 IF4 GDC CONTROL DECODER Circuit Card Assembly

*670-0932-00 Complete Card

Capacitor

Tolerance ±20% unless otherwise indicated.

C1	283-0059-00	1 μF	Cer	25 V	+80%—20%	

A4 IF4 GDC CONTROL DECODER Circuit Card Assembly (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
		Resistor		
Resistors are fixed, composition, ±10% unless otherwise indicated.				
R1	316-0102-00		1 kΩ	¼ W
		Integrated Circuits		
U1	156-0034-00			Dual 4-input gate. Replaceable by T. I. SN7420N
U2	156-0078-00			4 to 16 line decoder. Replaceable by T. I. SN74154N
U3	156-0078-00			4 to 16 line decoder. Replaceable by T. I. SN74154N
U4	156-0078-00			4 to 16 line decoder. Replaceable by T. I. SN74154N

A5 INTERFACE INTERCONNECT Circuit Board Assembly

*670-0915-00		Complete Board
	Connectors	
J31 thru J36	131-0762-01	Receptacle, electrical, 56 contact

SECTION 5

DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS

Symbols and Reference Designators

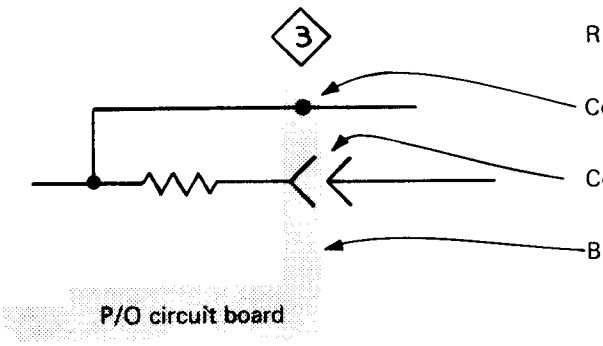
Electrical components shown on the diagrams are in the following units unless noted otherwise:

Capacitors =	Values one or greater are in picofarads (pF). Values less than one are in microfarads (μF).
Resistors =	Ohms (Ω)

Symbols used on the diagrams are based on USA Standard Y32.2-1967.

Logic symbology is based on MIL-STD-806B in terms of positive logic. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

The following special symbols are used on the diagrams:



Refer to diagram number indicated in diamond.

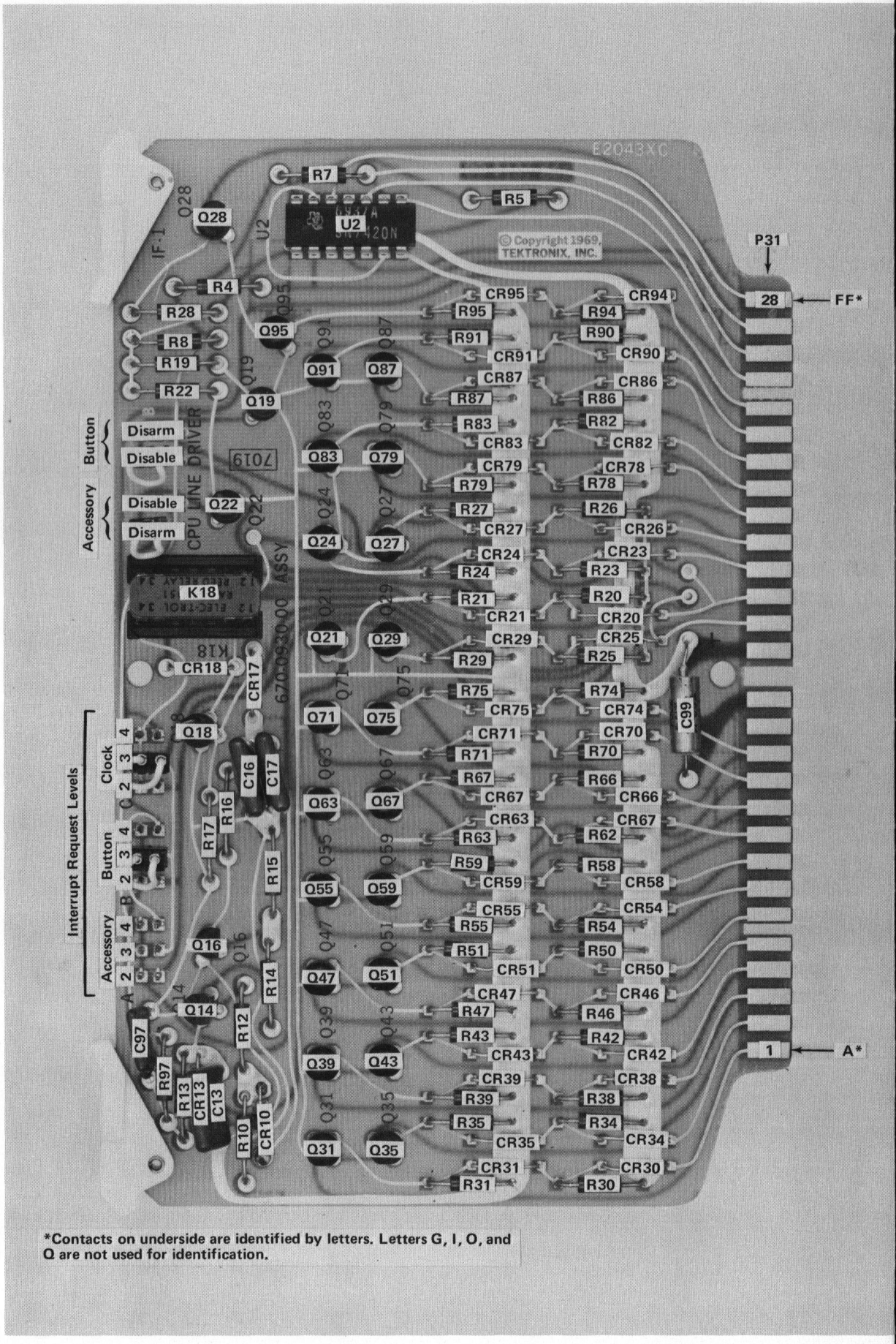
Connection soldered to circuit board.

Connection made to circuit board with interconnecting pin.

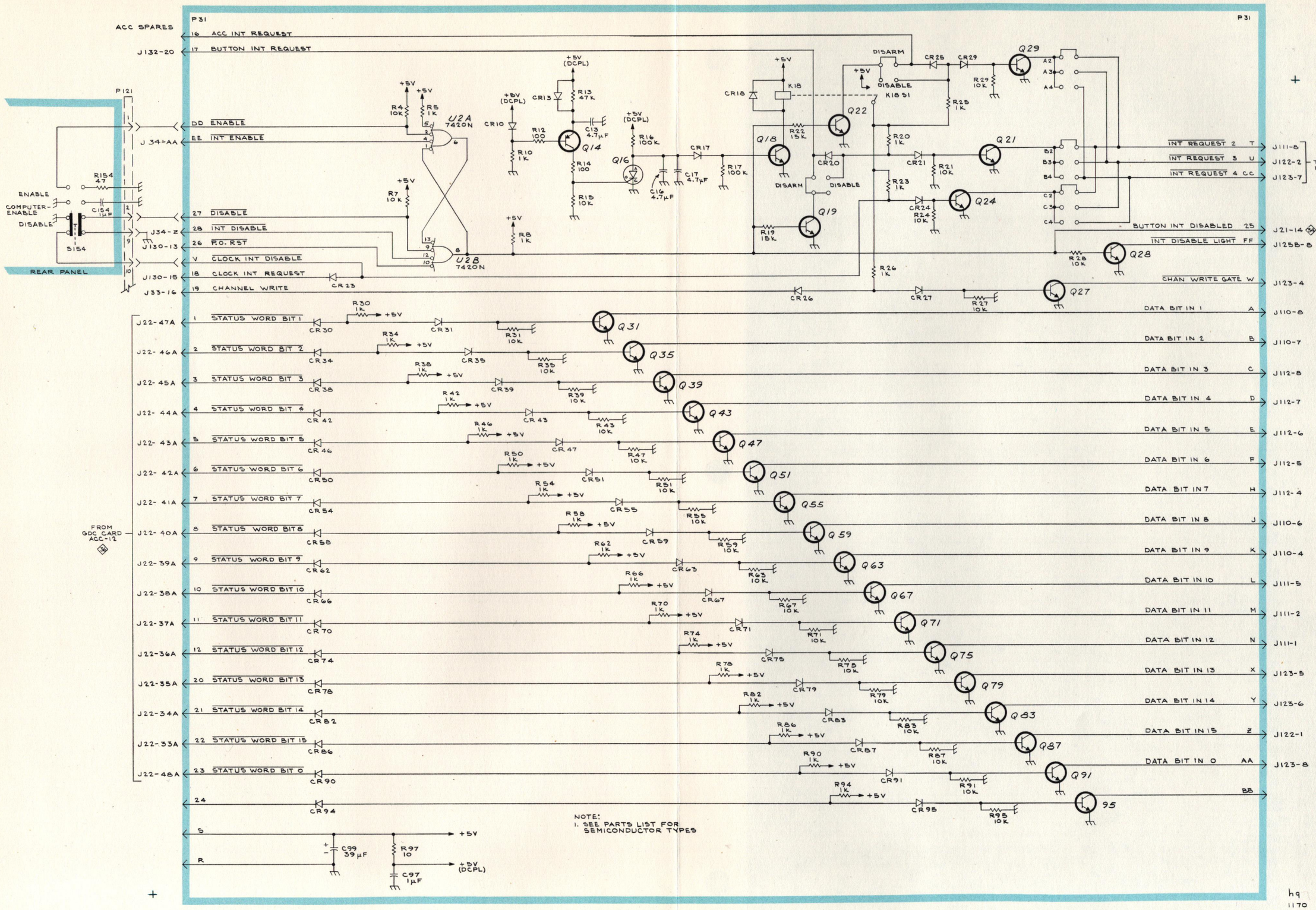
Blue tint encloses components located on circuit board.

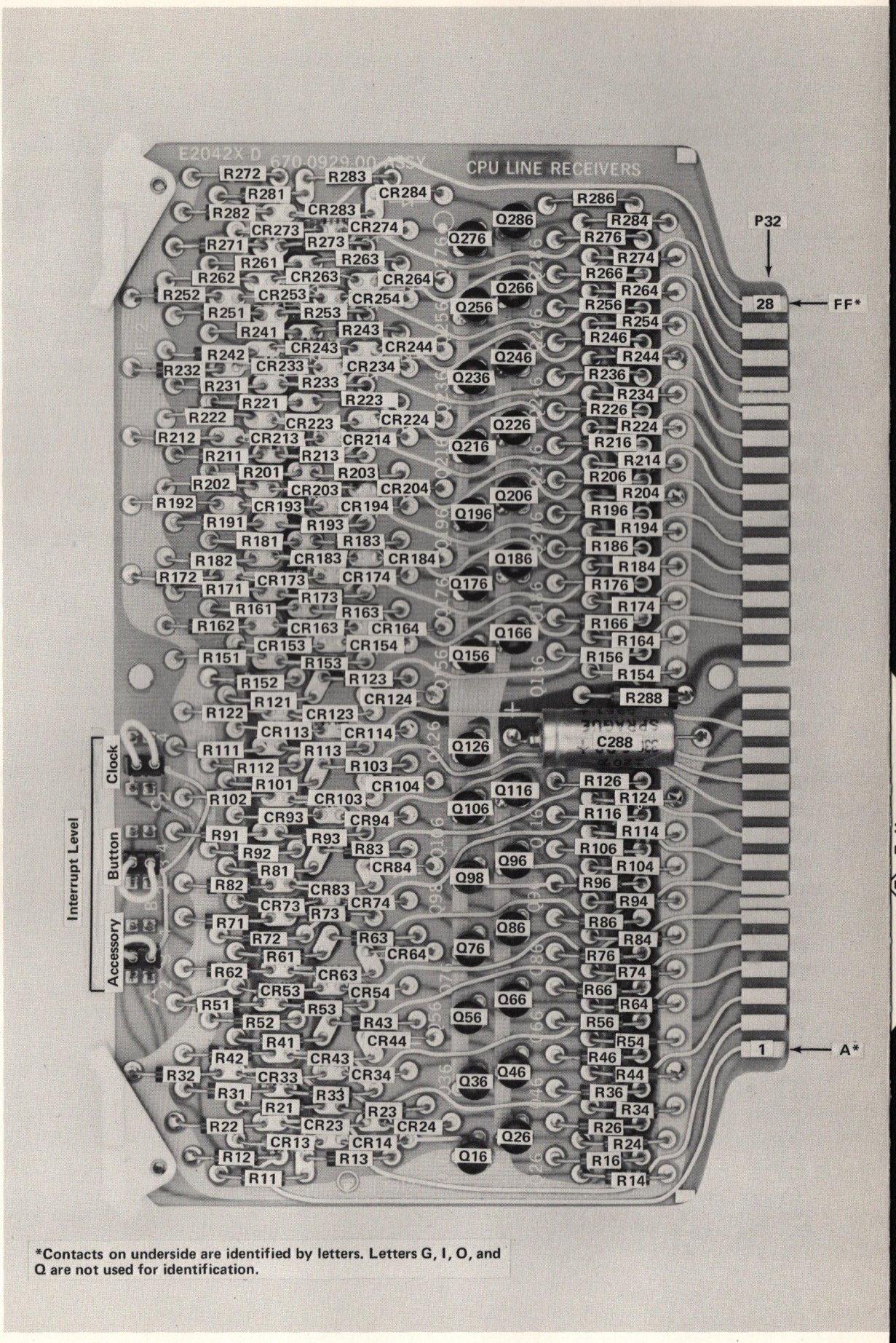
The following prefix letters are used as reference designators to identify components or assemblies on the diagrams.

A	Assembly, separable or repairable (circuit board, etc.)
AT	Attenuator, fixed or variable
B	Motor
BT	Battery
C	Capacitor, fixed or variable
CR	Diode, signal or rectifier
DL	Delay line
DS	Indicating device (lamp)
F	Fuse
FL	Filter
H	Heat dissipating device (heat sink, heat radiator, etc.)
HR	Heater
J	Connector, stationary portion
K	Relay
L	Inductor, fixed or variable
LR	Inductor/resistor combination
M	Meter
Q	Transistor or silicon-controlled rectifier
P	Connector, movable portion
R	Resistor, fixed or variable
RT	Thermistor
S	Switch
T	Transformer
TP	Test point
U	Assembly, inseparable or non-repairable (integrated circuit, etc.)
V	Electron tube
VR	Voltage regulator (zener diode, etc.)
Y	Crystal



*Contacts on underside are identified by letters. Letters G, I, O, and Q are not used for identification.


ACC SPARES
P31
16 ACC INT REQUEST
J132-20 17 BUTTON INT REQUEST
P121
DD ENABLE
J 34-AA EE INT ENABLE
ENABLE
COMPUTER-ENABLE
DISABLE
R154 47
C154 1μF
S154
REAR PANEL
27 DISABLE
J34-Z 28 INT DISABLE
J130-13 26 P.O. RST
V CLOCK INT DISABLE
J130-15 18 CLOCK INT REQUEST
J33-16 19 CHANNEL WRITE
CR23
U2A 7420N
U2B 7420N
R4 10K
R5 1K
R7 10K
R8 1K
+5V
+5V (DCPL)
CR10
CR13
R10 1K
R12 100
R13 47K
C13 4.7μF
Q14
R14 100
R15 10K
Q16
R16 100K
C16 4.7μF
CR17
C17 4.7μF
R17 100K
Q18
CR18
K18
R22 15K
Q22
DISARM
DISABLE
K18S1
CR25
CR29
R29 10K
Q29
R25 1K
R20 1K
Q21
CR20
CR21
R21 10K
R23 1K
CR24
R24 10K
Q24
Q19
R19 15K
R26 1K
CR26
CR27
R27 10K
Q27
R28 10K
Q28
A2
A3
A4
B2
B3
B4
C2
C3
C4
INT REQUEST 2 T J111-8
INT REQUEST 3 U J122-2
INT REQUEST 4 CC J123-7
TO IBM 1130
BUTTON INT DISABLED 25 J21-14
INT DISABLE LIGHT FF J125B-8
CHAN WRITE GATE W J123-4
DATA BIT IN 1 A J110-8
DATA BIT IN 2 B J110-7
DATA BIT IN 3 C J112-8
DATA BIT IN 4 D J112-7
DATA BIT IN 5 E J112-6
DATA BIT IN 6 F J112-5
DATA BIT IN 7 H J112-4
DATA BIT IN 8 J J110-6
DATA BIT IN 9 K J110-4
DATA BIT IN 10 L J111-5
DATA BIT IN 11 M J111-2
DATA BIT IN 12 N J111-1
DATA BIT IN 13 X J123-5
DATA BIT IN 14 Y J123-6
DATA BIT IN 15 Z J122-1
DATA BIT IN 0 AA J123-8
BB
FROM GDC CARD ACC-12
J22-47A 1 STATUS WORD BIT 1
J22-46A 2 STATUS WORD BIT 2
J22-45A 3 STATUS WORD BIT 3
J22-44A 4 STATUS WORD BIT 4
J22-43A 5 STATUS WORD BIT 5
J22-42A 6 STATUS WORD BIT 6
J22-41A 7 STATUS WORD BIT 7
J22-40A 8 STATUS WORD BIT 8
J22-39A 9 STATUS WORD BIT 9
J22-38A 10 STATUS WORD BIT 10
J22-37A 11 STATUS WORD BIT 11
J22-36A 12 STATUS WORD BIT 12
J22-35A 20 STATUS WORD BIT 13
J22-34A 21 STATUS WORD BIT 14
J22-33A 22 STATUS WORD BIT 15
J22-48A 23 STATUS WORD BIT 0
24
CR30 CR31 CR34 CR35 CR38 CR39 CR42 CR43 CR46 CR47 CR50 CR51 CR54 CR55 CR58 CR59 CR62 CR63 CR66 CR67 CR70 CR71 CR74 CR75 CR78 CR79 CR82 CR83 CR86 CR87 CR90 CR91 CR94 CR95
R30 1K
R31 10K
R34 1K
R35 10K
R38 1K
R39 10K
R42 1K
R43 10K
R46 1K
R47 10K
R50 1K
R51 10K
R54 1K
R55 10K
R58 1K
R59 10K
R62 1K
R63 10K
R66 1K
R67 10K
R70 1K
R71 10K
R74 1K
R75 10K
R78 1K
R79 10K
R82 1K
R83 10K
R86 1K
R87 10K
R90 1K
R91 10K
R94 1K
R95 10K
Q31 Q35 Q39 Q43 Q47 Q51 Q55 Q59 Q63 Q67 Q71 Q75 Q79 Q83 Q87 Q91 95
S
R
C99 39μF
R97 10
C97 1μF
+5V
+5V (DCPL)
NOTE:
1. SEE PARTS LIST FOR SEMICONDUCTOR TYPES



*Contacts on underside are identified by letters. Letters G, I, O, and Q are not used for identification.

NOTE:
1. SEE PARTS LIST FOR SEMICONDUCTOR TYPES

P32

J112-3	1	CHAN INT LEV 2	
J112-2	2	CHAN INT LEV 3	
J112-1	3	CHAN INT LEV 4	
J113-8	4	X10 E1 CYCLE	
J113-7	5	CHANNEL RESET	
J113-6	6	CPU CLOCK TØ	
J113-5	7	CPU CLOCK T4	
J113-4	8	CPU CLOCK T6	
J113-3	9	METER OUT	
J113-2	10	DATA BIT OUT Ø	
J113-1	11	DATA BIT OUT 1	
J114-8	12	DATA BIT OUT 2	
	13		
J114-7	16	DATA BIT OUT 3	
J114-6	17	DATA BIT OUT 4	
J114-5	18	DATA BIT OUT 5	
J114-4	19	DATA BIT OUT 6	
J122-3	20	DATA BIT OUT 7	
J122-4	21	DATA BIT OUT 8	
J122-5	22	DATA BIT OUT 9	
J122-6	23	DATA BIT OUT 10	
J122-7	24	DATA BIT OUT 11	
J122-8	25	DATA BIT OUT 12	
J114-2	26	DATA BIT OUT 13	
J114-1	27	DATA BIT OUT 14	
J114-3	28	DATA BIT OUT 15	

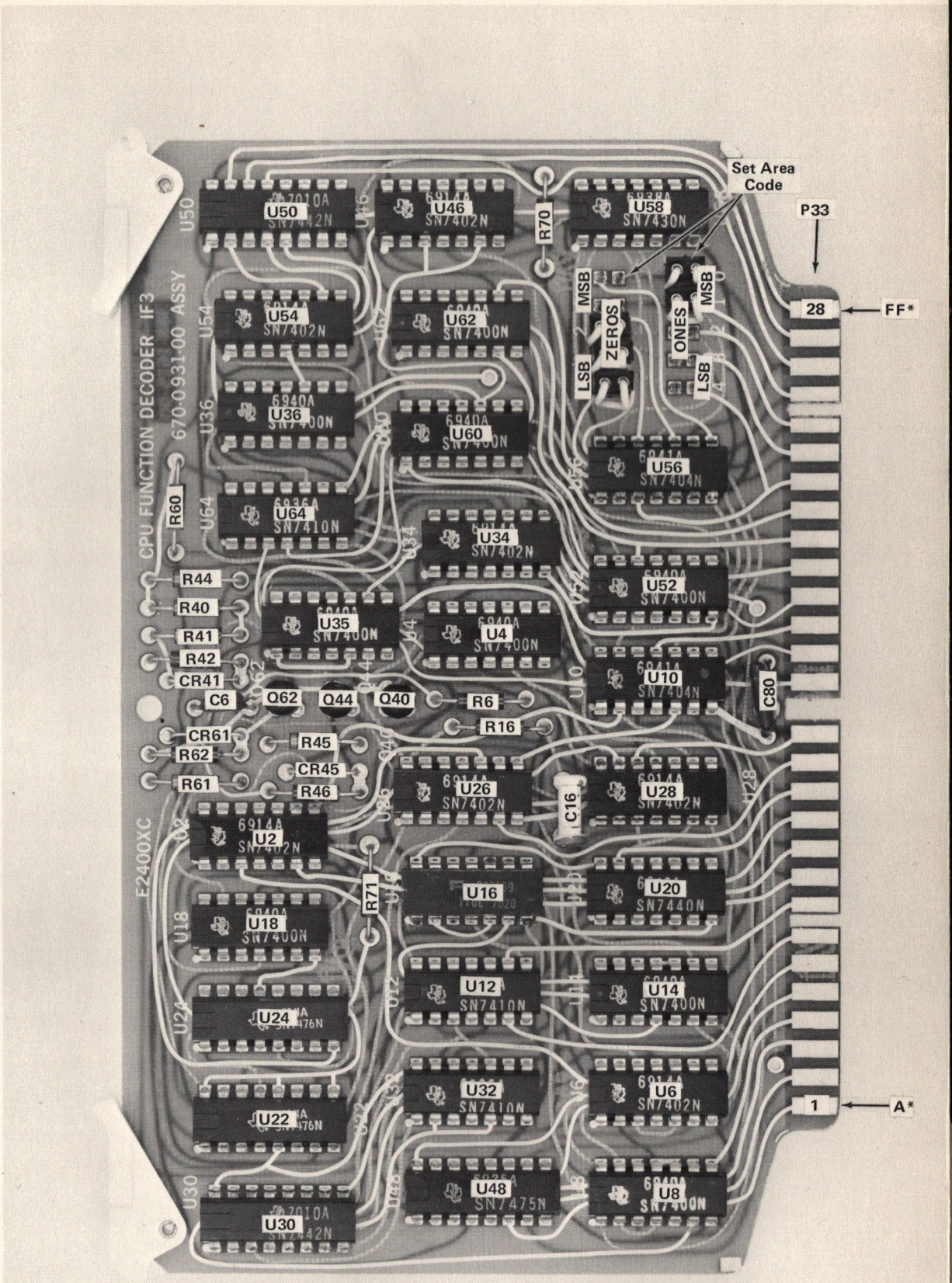
INTERRUPT LEVEL SWITCH

B2	BUTTON INT LEVEL	A	J33-U
B3			
B3			
A2			
A3			
A4	ACC INT LEVEL	B	J131-10
C2	CLOCK INT LEVEL	C	J33-T
C3			
C4	X10	D	J33-Z
	COMPUTER RESET	E	J130-14
	TØ	F	J33-21
	T4	H	J33-19
	T6	J	J33-20
	PROCESSOR RUNNING LIGHT	K	J125D-3 ◇1
	CPU BIT Ø	L	J33-DD
	CPU BIT 1	M	J33-25
	CPU BIT 2	N	J33-24
		P	
	CPU BIT 3	T	J33-23
	CPU BIT 4	U	J33-22
	CPU BIT 5	V	J33-26
	CPU BIT 6	W	J33-27
	CPU BIT 7	X	J33-28
	CPU BIT 8	Y	J132-16
	CPU BIT 9	Z	J133-21
	CPU BIT 10	AA	J133-4
	CPU BIT 11	BB	J133-5
	CPU BIT 12	CC	J132-15
	CPU BIT 13	DD	J132-18
	CPU BIT 14	EE	J132-14
	CPU BIT 15	FF	J133-22

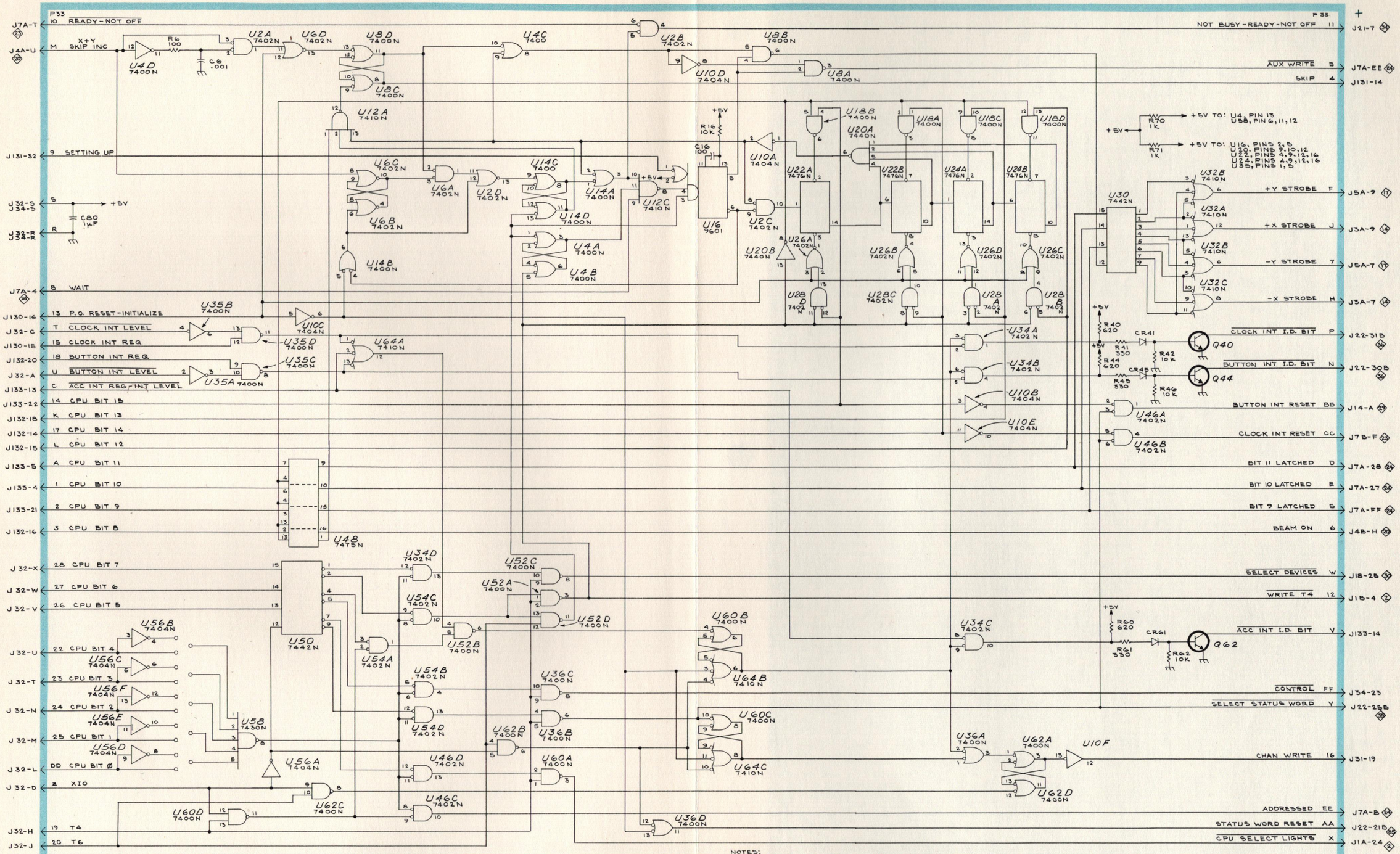
FROM 18M 1130 ⊗

R288 1.2 S +5V
C288 330 µF
R

A2 CPU LINE RECEIVER IF-2 ◇2 hq 1170



*Contacts on underside are identified by letters. Letters G, I, O, and Q are not used for identification.

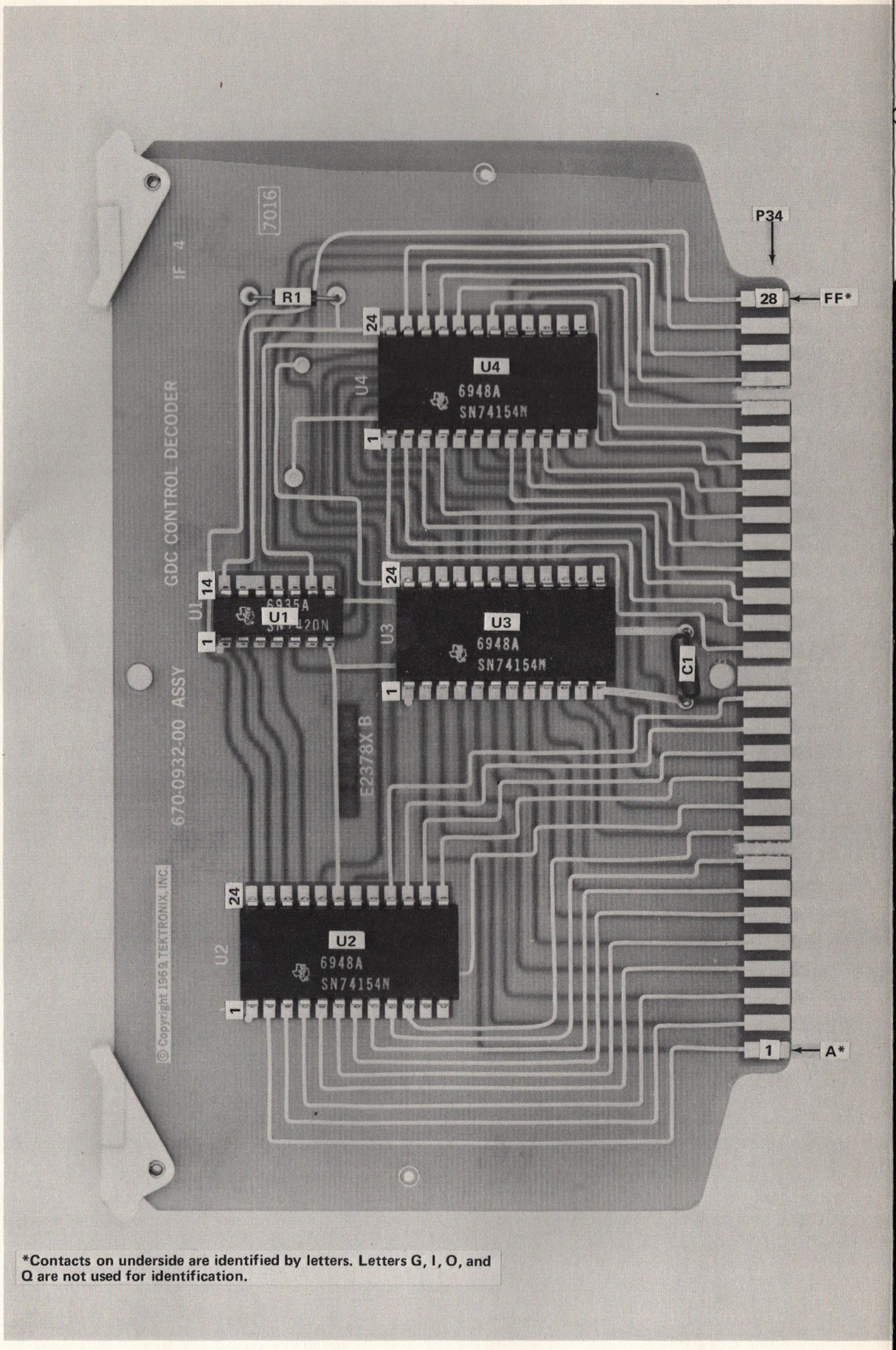


NOTES:
1. SEE PARTS LIST FOR SEMICONDUCTOR TYPES
2. ALL UNUSED IC PINS ARE CONNECTED TO GROUND OR Vcc

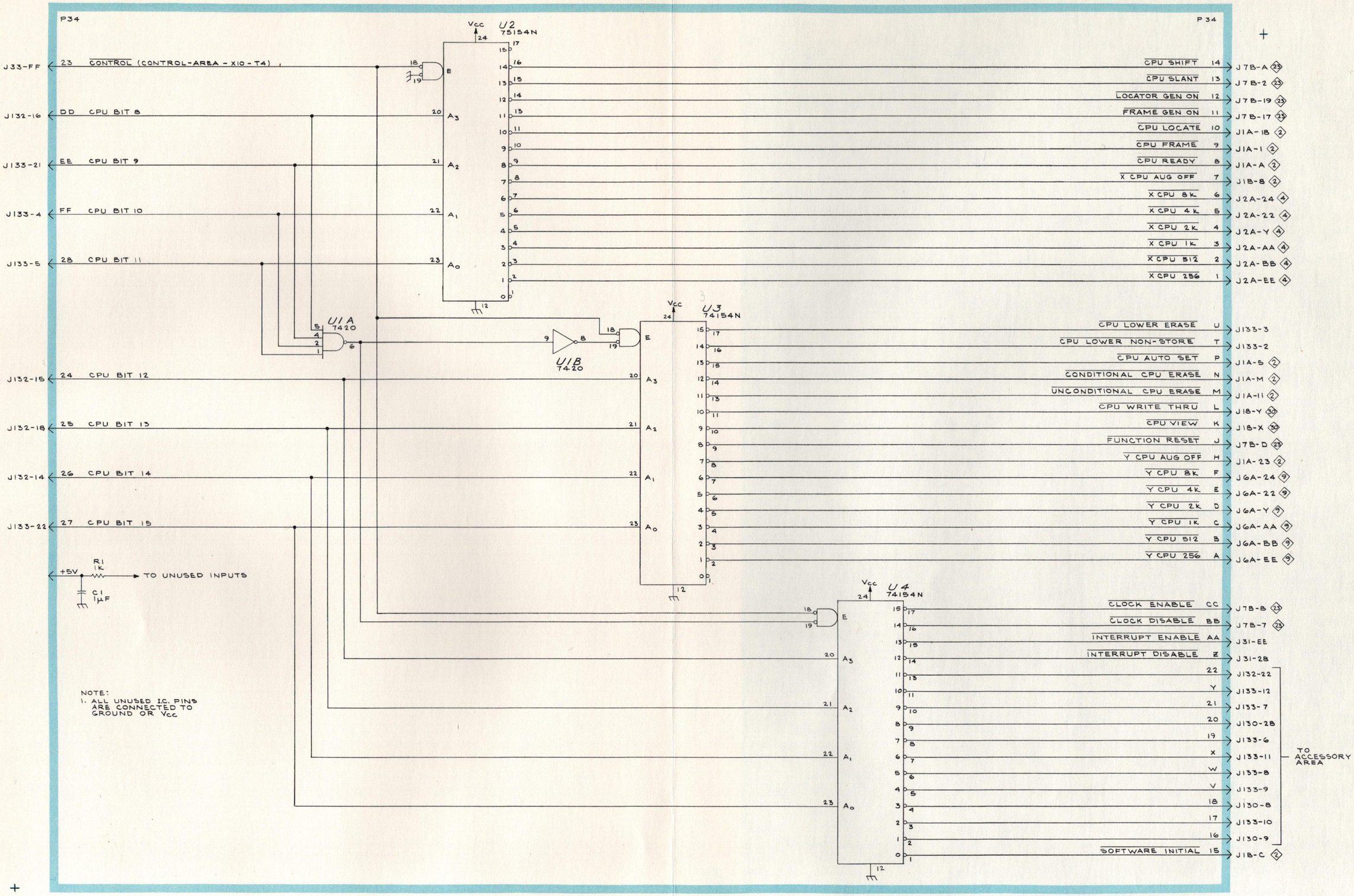
015-0180-00 INTERFACE UNIT

A3 CPU FUNCTION DECODER IF-3 hq 1170

IF-3



*Contacts on underside are identified by letters. Letters G, I, O, and Q are not used for identification.


P34
J33-FF 23 CONTROL (CONTROL-AREA - X10 - T4)
J132-16 DD CPU BIT 8
J133-21 EE CPU BIT 9
J133-4 FF CPU BIT 10
J133-5 28 CPU BIT 11
J132-15 24 CPU BIT 12
J132-18 25 CPU BIT 13
J132-14 26 CPU BIT 14
J133-22 27 CPU BIT 15
+5V
R1 1K
TO UNUSED INPUTS
C1 1μF
NOTE:
1. ALL UNUSED I.C. PINS ARE CONNECTED TO GROUND OR Vcc
U1A 7420
U1B 7420
U2 75154N
U3 74154N
U4 74154N
Vcc
E
A3
A2
A1
A0
P34
CPU SHIFT 14 J7B-A 23
CPU SLANT 13 J7B-2 23
LOCATOR GEN ON 12 J7B-19 23
FRAME GEN ON 11 J7B-17 23
CPU LOCATE 10 J1A-18 2
CPU FRAME 9 J1A-1 2
CPU READY 8 J1A-A 2
X CPU AUG OFF 7 J1B-8 2
X CPU 8K 6 J2A-24 4
X CPU 4K 5 J2A-22 4
X CPU 2K 4 J2A-Y 4
X CPU 1K 3 J2A-AA 4
X CPU 512 2 J2A-BB 4
X CPU 256 1 J2A-EE 4
CPU LOWER ERASE U J133-3
CPU LOWER NON-STORE T J133-2
CPU AUTO SET P J1A-5 2
CONDITIONAL CPU ERASE N J1A-M 2
UNCONDITIONAL CPU ERASE M J1A-11 2
CPU WRITE THRU L J1B-Y 30
CPU VIEW K J1B-X 30
FUNCTION RESET J J7B-D 23
Y CPU AUG OFF H J1A-23 2
Y CPU 8K F J6A-24 9
Y CPU 4K E J6A-22 9
Y CPU 2K D J6A-Y 9
Y CPU 1K C J6A-AA 9
Y CPU 512 B J6A-BB 9
Y CPU 256 A J6A-EE 9
CLOCK ENABLE CC J7B-8 23
CLOCK DISABLE BB J7B-7 23
INTERRUPT ENABLE AA J31-EE
INTERRUPT DISABLE Z J31-28
22 J132-22
Y J133-12
21 J133-7
20 J130-28
19 J133-6
X J133-11
W J133-8
V J133-9
18 J130-8
17 J133-10
16 J130-9
SOFTWARE INITIAL 15 J1B-C 2
TO ACCESSORY AREA

SECTION 6
MECHANICAL PARTS LIST

FIGURE 1 EXPLODED

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5	Description
1-	015-0180-00			1		INTERFACE UNIT, T4005 to 1130
	- - - - - -			-		interface unit includes:
-1	012-0215-00			1		CABLE, interconnecting
-2	343-0278-00			1		CLAMP HALF, cable, bottom
-3	343-0277-00			1		CLAMP HALF, cable, top
	- - - - - -			-		mounting hardware: *(not included w/clamp half)*
-4	211-0529-00			2		SCREW, 6.32 x 1.25 inches, PHS
-5	334-1634-00			1		PLATE, identification
-6	210-0457-00			6		NUT, keps, 6-32 x 0.312 inch
-7	211-0560-00			2		SCREW, 6-32 x 1 inch, RHS
-8	211-0537-00			2		SCREW, 6-32 x 0.375 inch, THS
-9	386-1791-00			1		PLATE, cable mounting
	- - - - - -			-		mounting hardware: *(not included w/plate)*
-10	211-0504-00			4		SCREW, 6-32 x 0.25 inch, PHS
-11	260-0450-00			1		SWITCH, slide
	- - - - - -			-		mounting hardware: *(not included w/switch)*
-12	211-0101-00			2		SCREW, 4-40 x 0.25 inch, 100° csk, FHS
-13	210-0460-00			2		NUT, hex., 4-40 x 0.188 inch
-14	670-0915-00			1		CIRCUIT BOARD ASSEMBLY—INTERFACE INTERCONNECT A5
	- - - - - -			-		circuit board assembly includes:
	388-1559-00			1		CIRCUIT BOARD
-15	131-0608-00			296		TERMINAL, pin, 0.365 inch long
-16	131-0762-01			6		CONNECTOR, receptacle, 56 contact
	- - - - - -			-		mounting hardware: *(not included w/circuit board assembly)*
	211-0008-00			12		SCREW, 4-40 x 0.25 inch, PHS *(not shown)*
-17	670-0930-00			1		CIRCUIT CARD ASSEMBLY—CPU LINE DRIVER A1 IF1
	- - - - - -			-		circuit card assembly includes:
	388-1613-00			1		CIRCUIT CARD
	105-0171-00			2		EJECTOR, circuit card, plastic
	- - - - - -			-		mounting hardware: *(not included w/ejector)*
	214-1337-00			1		PIN, spring, 0.25 inch long
-18	131-0608-00			26		TERMINAL, pin, 0.365 inch long
	131-0933-00			5		LINK, terminal connector
	- - - - - -			-		link includes:
-19	131-0707-00			2		CONNECTOR, terminal
-20	352-0169-00			1		HOLDER, terminal connector, 2 wire *(black)*
-21	136-0269-00			1		SOCKET, integrated circuit, 14 pin

FIGURE 1 EXPLODED (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5	Description
-22	670-0929-00			1		CIRCUIT CARD ASSEMBLY—CPU LINE RECEIVER A2 IF2
	- - - - - -			-		circuit card assembly includes:
	388-1613-00			1		CIRCUIT CARD
	105-0171-00			2		EJECTOR, circuit card, plastic
	- - - - - -			-		mounting hardware for each: *(not included w/ejector)*
	214-1337-00			1		SPRING, 0.25 inch long
-23	131-0608-00			18		TERMINAL, pin, 0.365 inch long
	131-0933-00			3		LINK, terminal connector
	- - - - - -			-		each link includes:
	131-0707-00			2		CONNECTOR, terminal
	352-0169-00			1		HOLDER, terminal connector, 2 wire *(black)*
-24	670-0931-00			1		CIRCUIT CARD ASSEMBLY—CPU FUNCTION DECODER A3 IF3
	- - - - - -			-		circuit card assembly includes:
	388-1615-00			1		CIRCUIT CARD
	105-0171-00			2		EJECTOR, circuit card, plastic
	- - - - - -			-		mounting hardware for each: *(not included w/ejector)*
	214-1337-00			1		PIN, spring, 0.25 inch long
-25	131-0608-00			20		TERMINAL, pin, 0.365 inch long
	131-0933-00			5		LINK, terminal connector
	- - - - - -			-		each link includes:
	131-0707-00			2		CONNECTOR, terminal
	352-0169-00			1		HOLDER, terminal connector, 2 wire *(black)*
-26	670-0932-00			1		CIRCUIT CARD ASSEMBLY—GDC CONTROL DECODER A4 IF4
	- - - - - -			-		circuit card assembly includes:
	388-1616-00			1		CIRCUIT CARD
-27	105-0171-00			2		EJECTOR, circuit card, plastic
	- - - - - -			-		mounting hardware for each: *(not included w/ejector)*
-28	214-1337-00			1		PIN, spring, 0.25 inch long

STANDARD ACCESSORIES

	070-1087-00			1		MANUAL, INSTRUCTION *(not shown)*

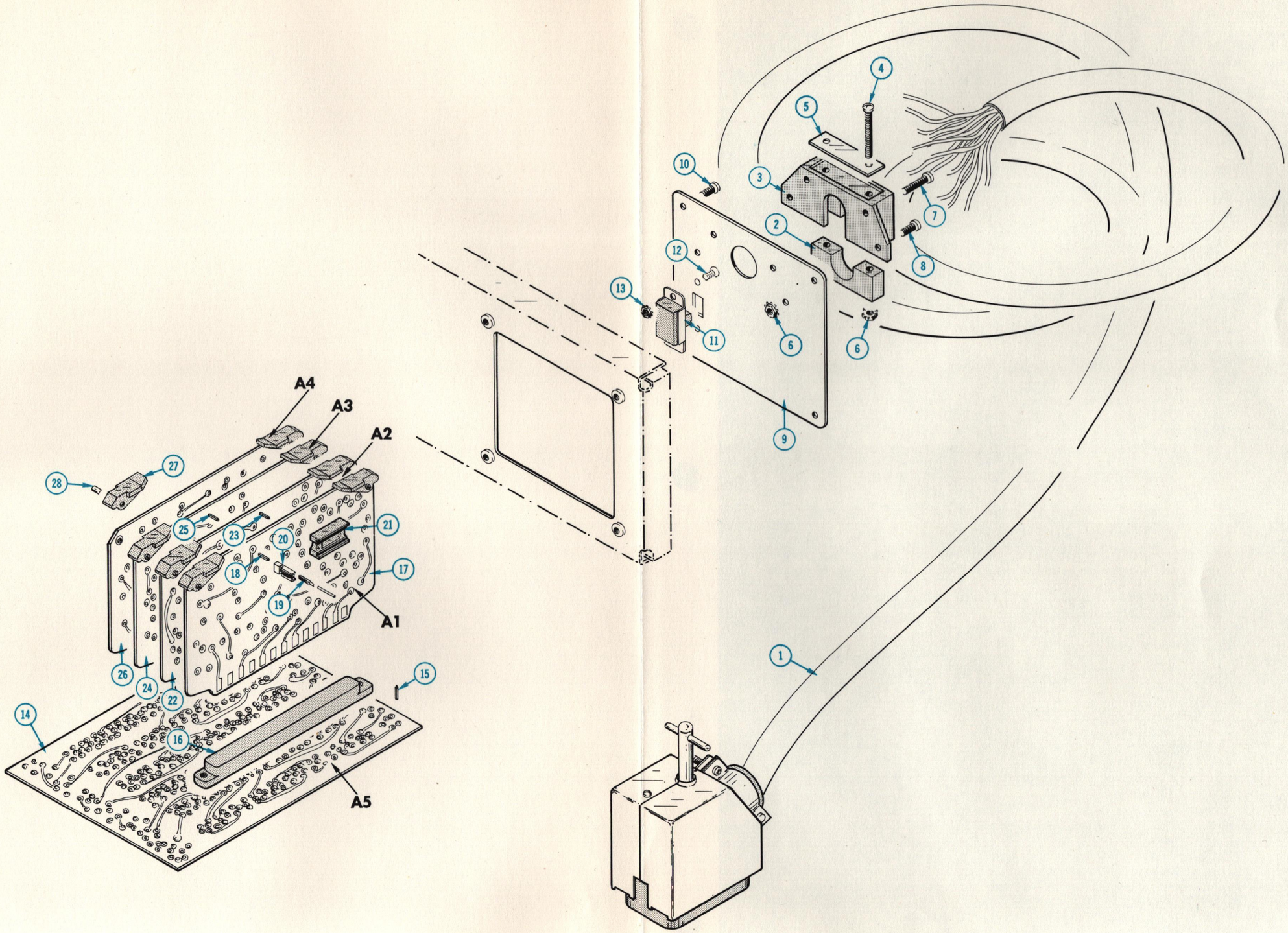


FIG. 1 EXPLODED